Swedish University of Agricultural Sciences
Faculty of Forest Sciences

Department of Forest Products, Uppsala

Sustainable urban development through increased construction in wood?

- A study of municipalities' cooperation in major construction projects in Sweden

Hållbar stadsutveckling genom ökad byggnation i trä?
- En studie om kommuners samverkan vid större byggprojekt i Sverige

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Keywords: building materials, climate, collaboration, construction project, multi-family housing, qualitative, semi structured, sustainability, wood construction

Master Thesis, 30 ECTS credit *Advanced level in Forest Sciences*
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Abstract

The increased awareness of the construction industry's impact on the global climate combined with the current housing shortage in Sweden has contributed to an increasing ask for more wood in construction amongst stakeholders, municipalities and politicians. In order to meet Sweden's climate goals it is necessary that new materials, technologies and working methods continue to evolve. Knowledge, cooperation and communication are described as important elements in order to develop the work towards increased sustainability in the construction sector in Sweden. Through different forms of cooperation, knowledge and risk can be spread between the involved actors in large capital-intensive construction projects while the construction process tends to be streamlined and life cycle costs minimized.

The purpose of this study is to explain the importance of cooperation between private and public actors in major construction projects in Sweden. The study focuses on perceived advantages and disadvantages with public-private partnership as collaborative form, but also how this interaction, through increased wood construction, can lead to more developed and sustainable urban development. The study focuses on how this form of cooperation can benefit both public actors, such as municipalities, as well as private actors on the market.

The study is based on qualitative interviews with representatives from seven different municipalities in Sweden. The sample for the study was carried out through active searches in the Central Statistics Office, where the selection of units was based on the number of completed apartment buildings during the last three and five year period. The reason why these municipalities were chosen with regard to the number of completed apartment buildings was based on the fact that they are deemed to have a great potential for expanded wood construction within the municipality. Another aspect that was included in the choice of respondent was that the municipalities that produce the most apartment buildings are expected to have a good insight into the complex issues that the study is focused on.

The results of the study show an overall positive image to wood as a building material. The main advantages of wood as a building material are described as the possibility of prefabrication, climate-friendly material and increased competition on the construction market. Perceived difficulties with wood as a building material is described as lack of knowledge and experience, conservative construction industry and that there are too few producers of building elements in wood.

The results show that cooperation between public and private actors is taking place in a large part of the municipalities today. Public-Private Partnership (PPP) is mainly used through project competitions and land display through open procedures. A majority of respondents argue that cooperation is very important within the municipality in order to be able to carry out these larger and more complex construction projects. These collaborations are described to increase the spread of knowledge between market actors, provide an opportunity for municipalities to influence the market, and that risks associated with the projects can be spread between the involved actors. Respondents describe that there are few disadvantages associated with public-private partnership. The disadvantages identified in this study are described as lack of skilled labour and that there is a difficulty in meeting the various interests of the cooperation.

Keywords: *building materials, climate, collaboration, construction project, multi-family housing, qualitative, semi structured, sustainability, wood construction*

Sammanfattning

Den ökade medvetenheten om byggindustrins påverkan på det globala klimatet i kombination med den rådande bostadsbristen i Sverige har gjort att allt fler intressenter, kommuner och politiker börjat efterfråga mer trä i byggande. För att kunna möta Sveriges klimatmål krävs att nya material, teknologier och arbetssätt fortsätter att utvecklas. Kunskap, samarbete och kommunikation beskrivs som viktiga element för att kunna utveckla arbetet mot ökad hållbarhet inom byggsektorn i Sverige. Genom olika samverkansformer kan kunskap och risk spridas mellan de involverade aktörerna vid större kapitalintensiva byggprojekt samtidigt som byggprocessen tenderar att effektiviseras och livscykelkostnaderna minimeras.

Syftet med detta arbete är att belysa vikten av samverkan mellan privata och offentliga aktörer vid större byggprojekt i Sverige. Studien inriktas mot upplevda fördelar och nackdelar med dels public-private partnership som samverkansform men även hur denna samverkan, genom ökad byggnation i trä kan leda till en mer utvecklad och hållbar stadsutveckling. Arbetet fokuseras på hur denna samverkansform kan gynna såväl offentliga aktörer, så som kommuner, samt privata aktörer på marknaden.

Studien baseras på kvalitativa intervjuer med representanter från sju olika kommuner i Sverige. Urvalet till studien skedde genom aktiva sökningar i statistiska centralbyrån där val av enhet grundades på antal färdigställda flerbostadshus under den senaste tre och fem åren. Anledningen till att dessa kommuner valdes med hänseende till antal färdigställda flerbostadshus grundades på att dessa bedöms ha en stor potential till en utökad träbyggnation inom kommunen. En annan aspekt som togs med vid valet av respondent var att de kommuner som producerar flest flerbostadshus bedöms ha en god inblick i de komplexa frågor som studien inriktas mot.

Studiens resultat visar en övergripande positiv bild till trä som byggmaterial. De största fördelarna med trä som byggmaterial beskrivs som möjligheten till prefabricering, klimatvänligt material samt att det blir en ökad konkurrens på byggmarknaden. Upplevda svårigheter med trä som byggmaterial beskrivs som brist på kunskap och erfarenhet, konservativ byggindustri samt att det finns för få producenter av byggelement i trä.

Resultatet visar att samverkan mellan offentliga och private aktörer sker i en stor del av kommuner som ingår i denna studie. Public-Private Partnership (PPP) används framförallt genom markanvisningstävlingar och markanvisning genom öppet förfaranden. En majoritet av respondenterna menar att samarbetet är mycket viktiga inom kommunen för att kunna genomföra dessa större och mer komplexa byggprojekt. Dessa samarbeten beskrivs öka kunskapsspridningen mellan marknadens aktörer, ger en möjlighet att kunna påverka marknaden samt att risker kopplade till projekten kan spridas mellan de involverade aktörerna. Respondenterna beskriver att det finns få nackdelar kopplade till PPP. De nackdelar som framkom genom denna studie beskrivs som brist på kunnig arbetskraft samt att det finns en svårighet kring att tillgodose samarbetets olika intressen.

Nyckelord: *byggmaterial, byggprojekt, flerbostadshus, hållbarhet, klimat, kvalitativ, samarbete, semistrukturerad, träbyggnation*

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First and foremost, I would like to express my sincere thanks to my supervisor, Anders Lindhagen, and his colleagues at the Department of Forest Economics. You have been the best possible support throughout the course.

Many thanks to the municipalities and respondents who chose to participate in this study. It was very interesting and instructive to interview you all and at the same time get a picture of your work linked to major construction projects within the municipality. Your knowledge, together with your showed interest, made this study feasible.

Finally, I would like to thank those in my presence who supported, encouraged and provided feedback during the course. Many thanks.

Fredrik Sjöström
Uppsala 2018-11-02

Abbreviations

CO_2 eq/m^2 Atemp – Carbon dioxide equivalents per square meter.

NBHBP – National Board of Housing, Building and Planning

PPP – Public-private partnership

SALAR – Swedish Association of Local Authorities and Regions

SCB – Statistics Sweden (Central Statistics Office)

SEPA - Swedish Environmental Protection Agency

Table of Contents

List of Illustrations

List of tables

1 Introduction

This first chapter presents an overall background to the problem chosen to be studied. Then the purpose and questions of the study are presented. The chapter concludes with an illustrative image with descriptive text to give the reader an overall picture of the different parts and structure of the study.

1.1 Problem background

During the seventeenth and eighteenth century, Sweden suffered from heavy city fires, which resulted in a large proportion of urban residents becoming homeless. During this period, fire was used for heating as well as light and the houses were closely assembled and built using wood as material. This is described as the most significant cause of urban fires being developed frequently in Sweden's cities during this time (Värmland Fire History Club, 2018). In order to counteract these city fires so-called fire regulations developed which regulated, among other things, the construction techniques that could be used as well as the use of various building materials for multi-family houses. These regulations are described as a tool for actively trying to combat these devastating fires in Sweden's cities (Harrison, 2016). In 1874, a prohibition was imposed on using wood as building materials in houses higher than two floors, and this prohibition lasted for 120 years until 1994 (Hellsborn & Nilsson, 2010).

NBHBP building rules 94:1 (NBHBP 94:1) was developed in 1994, which again allowed wood to be used as supporting material in multi-family houses in Sweden. In connection with the abolition of this restriction, increased demand for wood construction from both individuals and municipalities has emerged. This has in turn entailed a growing demand for suppliers and manufacturers of wooden building elements (SALAR, 2013). In order to meet the growing demand for wood as building materials, more and more actors in recent years have chosen to develop and expand their industries (Södra, 2017a).

According to SALAR (2013) wood as building materials has increased in recent years. Positive effects from increased wood construction are described as shorter construction times, reduced climate impact, increased collaboration between market actors and new technology progressively developed on the market (SALAR, 2013). The prohibition of using wood as building material has thus contributed to the fact that other building materials such as steel and concrete with their advantageous characteristics have become the market leader in the construction sector (Hellsborn & Nilsson, 2010).

1.2 Problem

According to Belz & Peattie (2012), the nineteenth century is characterized by an increased burning of fossil fuels, which is described as a result of increased population density and economic growth around the world. The market has, through its growing awareness of greenhouse gas's impact on the global climate, begun to place increasing demands on companies, authorities and politicians. This growing awareness among market actors and stakeholders contributes to an increased demand for alternative materials, technologies and methods to reduce the climate impact.

Reasons that wood as building material has increased in recent years is described as the increasing awareness of the building industry's environmental impact, but also that politicians in Sweden have begun to demand more wood in construction (The Swedish Parliament, Ds

2004:1). According to a report from IVA (2014), the construction sector contributes to large greenhouse gas emissions every year. The report focuses on today's most common building materials steel and concrete and shows that most of the emissions are made when the building material are being produced (IVA, 2014. p.12). This report shows that the construction industry in Sweden is responsible for 10 million tonnes of carbon dioxide equivalent per year. Of these, 6 million tonnes arise from construction projects, while the remaining 4 million tonnes arise in small-scale construction. Emission of 10 million tonnes of carbon dioxide equivalent per year is described to be in the same order as the emissions from Sweden's all passenger cars in 2012 (IVA, 2014, p.21).

According to SALAR (2013), the public actor´s choice of building systems have major consequences for the climate impact that the construction projects entail, but also for the municipality's future economy. In order to meet Sweden's climate targets while ensuring a strong economy within the municipality, new materials, technologies and working methods must continue to develop. Through society's increasing awareness of the climate impact of the construction industry, together with today's rising building costs, it is estimated that there is a great potential for new building systems and technologies to challenge the construction industry's market shares.

Bergqvist (2015) highlights knowledge, cooperation and communication as important elements in order to develop work towards increased sustainability in Sweden. The prohibition of using wood as a bearing material has meant that knowledge and experience has become a limiting factor for modern wood construction in Sweden. According to representatives of one of Sweden's largest forest-owner association, Södra (2017b), today's discussions between market actors shows that access to land, lack of knowledge and lack of technology are the primary limiting factors for today's wood construction. Collaborations are therefore described as important in the development towards an increased wood construction in Sweden. Through different forms of cooperation, knowledge and risk can be spread between the involved actors in large capital-intensive construction projects while the construction process tends to be more efficient and life cycle costs minimized (SALAR, 2009).

However, according to Bovaird (2004), a critical approach has developed towards different collaborative solutions since they have evolved. This critical attitude is aimed primarily at using private companies in the interests of the public as they are described as profitable. Trade unions are also described as critical of collusion solutions, which is based on the perception that employment conditions may deteriorate while job opportunities for local contractors may decrease.

1.3 Aim

The purpose of this study is to explain the importance of public-private partnerships, **PPP**[1], for major wood construction projects in Sweden. The underlying ambition is to understand how municipalities in Sweden use public-private partnerships in major construction projects and how this collaboration, through increased wood construction, can contribute to a more sustainable urban development. The work focuses on the perceived advantages and disadvantages of wood as building materials and how private and public actors on the market can benefit from collaborating.

[1] The concept of public-private partnership is presented in Chapter 2.3.

1.4 Research questions

Questions of particular interest to the study:

- What are the perceived advantages and disadvantages with wood as building materials in the construction of apartment buildings?

- What factors control the choice of building materials for major construction projects within the municipality?

- How can PPP combined with wood construction be a potential tool to address complex issues such as the climate issue and housing shortage in Sweden?

1.5 Principal delimitations

Delimitations are used to direct the study towards its purpose and research questions. The public-private partnership can be used in a variety of business areas, such as in the construction industry, healthcare or infrastructure. This form of cooperation is usually used to transfer parts of the public actors responsibility to one or more private actors. Thus, the private actor becomes responsible for financing, building and operating a public utility while being responsible of a public interest for a longer period of time (Glasbergen, 2011).

This study are being focused on public-private partnership in the construction industry in Sweden. Wood construction is a large concept of a relative that can include both multi-family houses and single-family houses. This study focuses on major municipal projects such as multi-family houses and other major municipal construction projects. The reason for this delimitation is based on the fact that a large part of Sweden's single-family houses are already built with the wood material today, compared to multi-family houses where steel and concrete materials are clearly dominant. The study are therefore being focused on the representatives of municipalities' experienced advantages and disadvantages of wood as building material in multi-family houses, where the potential for developing wood construction is considered to be great.

More details regarding delimitations are provided in chapter 3.8.

1.6 Outline

Chapter 1 gives the reader an overall background to the problem chosen to be further studied in this work. The chapter presents the purpose of the work, questions and delimitations to clarify what the study intends to study. In order for the study to be addressed to the problem and purpose formulated, boundaries are discussed further in Chapter 3, "Method". Figure 1 gives the reader an illustrative picture of the different parts and structure of the work.

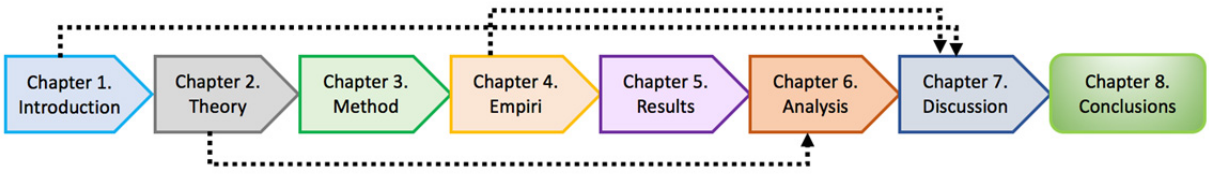

Figure 1. Illustration of the outline of the study.

Chapter 1 Introduction: This chapter gives the reader a background to the problem chosen to be studied. It also presents the purpose of the study, research questions and overall delimitations that form the basis for the study.

Chapter 2 Theory: The theory chapter presents partnership public-private partnership focused towards the construction sector. This chapter also presents an idealized form of cooperation development as well as the driving factors that make different actors want to enter into partnerships in the market.

Chapter 3 Method: It presents the approach used in the work and the unit chosen to be studied, the choice of data collection method and the boundaries used in the work.

Chapter 4 Empiricism: This chapter presents the perceived advantages and disadvantages of wood as building materials, Sweden's housing situation and how Sweden has evolved towards increased wood construction.

Chapter 5 Result: This chapter presents the results obtained through the qualitative interviews carried out in the study.

Chapter 6 Analysis: The results of the qualitative interviews are analyzed and compared with the presented theory from Chapter 2.

Chapter 7 Discussion: The results found in the study together with the presented theory and empiricism are used to process and discuss the study's research questions.

Chapter 8 Conclusions: This chapter presented the conclusions that emerged from the study. The purpose of the study is answered and proposes further research in the field.

2 Theoretical perspective

This chapter is the theory of the study and is used throughout the discussion of the work as well as in the analysis chapter. The chapter aims to give the reader a deeper understanding of public-private partnership and how this form of collaboration is used on the market. The chapter gives the reader a background to the driving forces that form the basis for participants choosing to enter into partnerships and then the public-private partnership towards the construction sector in Sweden are being presented.

2.1 Collaboration to address Complex challenges

Cooperation between companies, organizations and public institutions has been increasingly demanded since the UN conference took place in Rio de Janeiro in 1992. This conference, which focused on the environment and development, has led to increased demand for cooperation in order to contribute to more sustainable development. Through partnerships between private companies, international organizations, public institutions and non-governmental organizations, greater market responsibility has been developed. One of the explanations for private companies choosing to enter into partnership with other actors is the increased awareness of the company's stakeholders. Market demands for sustainable development and accountability have recently increased which means that cooperation must be concluded to meet the public´s interest. Through cooperation, private companies can maintain their competitiveness in the market by showing responsibility for stakeholders. Issues of a more complex nature such as climate and sustainable development require cooperation is concluded as the individual actor cannot meet these complex challenges on its own (LaFrance & Lehmann, 2005).

Society's growing awareness of climate change has contributed to greater accountability and more developed sustainability work from private companies and interest groups. At the same time as awareness of these larger and more complex issues increases, the demand for collaborations in the market increases (Nidumolu *et al*. 2014). Complex issues such as climate change can, according to (Pinkse & Kolk, 2012), the individual actor not respond on its own. Therefore cooperation is required in order to address to these major problems. Cooperation between public, private and non-profit-making actors generates the ability of the various parties' strengths to be exploited, thereby creating an opportunity to meet these complex challenges (Pinkse & Kolk, 2012).

Waddock (1991) describes the role of collaborations as;

”the voluntary collaborative efforts of actors from organizations in two or more economic sectors in a forum in which they cooperatively attempt to solve a problem or issue of mutual concern that is in some way identified with a public policy agenda item” (Waddock, 1991, p.483)

Waddock (1991) elaborates cooperation as voluntary where the actors work together to address a problem affecting most parties. In these partnerships, the actors work to achieve the interests of the general public as the operator's own interest. In this way, collaboration can benefit several different stakeholders, while at the same time meeting the individual actor´s. Together, actors can address problems that the individual actor cannot respond on their own, while a shared responsibility is created on the market. Another important factor influencing the commitment of the partnership among private actors is the perceived participation in

cooperation and its achievements. Stakeholder involvement correlates strongly to the feeling of being able to add value to the collaboration while achieving common and individual goals (Pinkse & Kolk, 2012).

2.2 Idealized form of Cooperation's Development

A collaborative process can be divided into different steps which determine how collaboration develops. Successful cooperation favours many different interests and this collaborative process can, according to Glasbergen (2011), be divided into 5 different steps as shown in Figure 2. It should be added that the steps in Figure 2 are presented in an idealized form, where the sequence of steps can vary in reality. Step 1-3 focus on the internal interactions between different actors in the collaboration while steps 4 and 5 focus on the external interactions (Glasbergen, 2011).

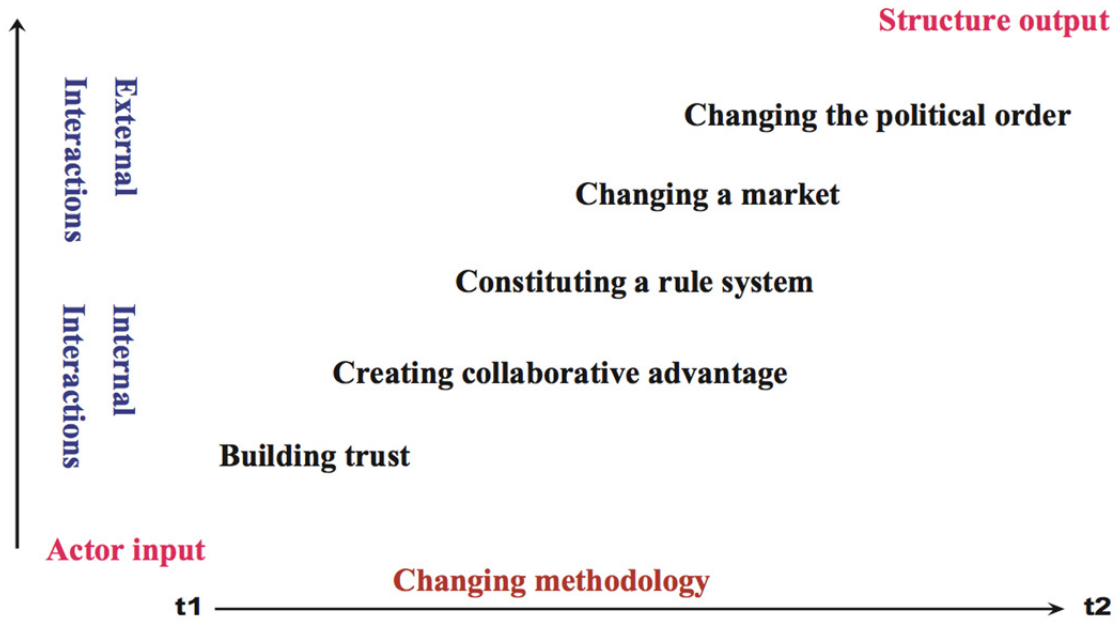

Figure 2. A model for an idealized form of cooperation development (Glasbergen, 2011. p.4).

The model is divided into five levels, or steps, which describe how a partnership can evolve over time. In short, the first step is to build trust between the actors involved and this step is described as exploratory. The next step describes the importance of creating common objectives and competitive advantages through the partnership. The third step is to set up a regulatory system that regulates the various tasks and responsibilities of the partnership. The two remaining levels, which are divided into external interactions, describe how the acquis is implemented and how cooperation can change the political order of the market. The change of the political order should be described as an objective of the cooperation and which is addressed throughout the collaboration process. This cooperation creates the opportunity for private and public actors to respond to and tackle larger and more complex public issues (Glasbergen, 2011). The following describes every step of the model in order to give the reader a better understanding of how an idealized form of cooperation can be developed in the market.

2.2.1 Internal interactions

A closer presentation of Glasbergen´s (2011) collaboration development model is provided below.

1. *Building Trust*

The first step in successful cooperation is based on building mutual trust between the actors involved in the cooperation. In cooperation, the actors can be dependent on each other in order to meet all the challenges facing the private and public sector. These collaborations are based on creating added value, and as such, trust between the actors is described as very important. This trust must be created and does not occur spontaneously. Therefore, in these methods of cooperation, rules must be formulated that regulate the views of each actor and respect all parties regardless of status or power (Glasbergen, 2011).

2. *Creating Collaborative advantage*

In collaboration, many interests are to be met at the same time as challenges are to be addressed. Each actor in the form of cooperation has its own interests which are important to fulfil. Hence, cooperation must generate value for all actors involved in order to create the necessary benefits to attract the actor to enter into partnerships.

For companies, collaborative forms may be part of its competition strategy. By entering into partnerships, the company's reputation can be improved towards its stakeholders by showing, for example, greater responsibility. For governments, a partnership can provide opportunities to meet major complex challenges by exploiting competencies from private actors and associations that already operate on the market.

Partnerships can thus create benefits for different actors, depending on the goals and results. However, It should be added that a partnership needs to generate benefits that the actor cannot develop on its own in order to attract the right actor into the cooperation. This is one of the driving forces of a partnership, to generate competitive advantages for each actor by entering into partnerships *(ibid).*

3. *Constituting a rule system*

A regulatory system can be used within a partnership, for example to avoid misunderstandings, to coordinate and to determine how unforeseen problems or events are to be addressed. This regulatory system can be set up as a certification, a code of conduct or an eco-label, for example. A regulatory system is also important for structuring different problem definitions or obligations that the various actors have in the partnership. In this regulatory system, the actors different tasks can be defined and how decisions processes, monitoring and execution are to be distributed within the cooperation.

This third step in the collaborative process means that cooperation is governed by a regulatory system. How the actors relate to the rules are described influencing the first two steps of the collusion process, building trust and designing common competitive advantages. Through this system of rules, voluntarism is discontinued in the form of cooperation and thus becomes a commitment. However, it appears that certain collaborations, where there is a high level of trust between the various actors, only use overall rules and regulations. A high degree of trust can lead to less need for strict agreements and regulations *(ibid).*

2.2.2 External interactions

4. *Changing a market*

Step 4 focuses on larger and more comprehensive goals which the cooperation strives to achieve. Examples of such targets can be an increased sustainability in a given market. By meeting economic, social and environmental issues, collaborations can lead to more sustainable development. Certifications allow the market to be managed, based on environmental, economic and social aspects, while contributing to sustainable development. If the market is to be changed, forms of cooperation must be used to meet more interests while meeting larger and more complex issues. These complex issues can be those that governments are not able to meet on their own but must cooperate with, for example, interest organizations or private companies (Glasbergen, 2011).

5. *Changing the political order*

Through cooperation, part of the public actors responsibility and power can be transferred to the private actor. According to Glasbergen (2011), the partnerships have developed networks that influence the governance of society. This political power transferred to private and public actors means that partnerships can influence and coordinate actions that can lead to changes in society and on the market.

Partnership brings together market participants and coordinates to meet complex challenges while creating added value. Depending on the area and challenges to be treated, a group of actors working in a specific area will be organized and collaborate. Hence, the collaboration can organize the right actors to the right challenges to be solved.

Partnership can therefore develop a new environment where sustainability aspects can be discussed. Through these discussions and solutions, social management can change in a structured way. This means that large complex issues such as sustainability can be met. However, it should be added that the success of partnerships is often dependent on public actors as well as government policies *(ibid).*

2.3 Public-private partnership

Public-private partnership (**PPP**), is described as a collaboration between the profit-driven private sector and the taxpayer public sector (Hallström *et al*. 2014). According to Åstrand & Sannestad (2015), a PPP can be defined as a long-term contractual relationship between public and private actors, where the risk of the projects can be spread between the actors involved in the cooperation (Åstrand & Sannestad, 2015). Through PPP, resources and interests can be mixed and thereby bring benefits to all actors involved in cooperation. At the same time, it provides the opportunity to deal with more complex issues in order to meet public interests. This partnership between public and private actors has existed for a long time where history suggests that cooperation often leads to greater efficiency and innovation development, which can contribute to improved cities based on a sustainability perspective (Dutta, 2012). The cooperation is also described as generating new methods, techniques and approaches on the market as described resulting from the improved communication and dissemination of information between the actors (Bovaird, 2004).

Public-private partnership in the construction sector has increased significantly since the UN Environment Summit in Rio de Janeiro in 1992 (Bondesson & Erlingson, 2012). One of the reasons for this form of cooperation increased is that non-profit organizations and private companies realized that good cooperation could benefit both parties and more interests (Rotter

& Özbek, 2010). In 1993 a bill was submitted to the Sweden´s Parliament, which formed the basis for the first public-private partnership in Sweden. This proposition made it possible for government projects to be partially built and financed by private actors (Edmark, 2016).

LaFrance & Lehmann (2005) argues that both the private operator and the public operator can benefit from joining together in a partnership. The private operator usually has a high level of technical expertise as well as strong financial resources which the public actor request. The public actor contributes to the cooperation with its network, experience and know-how. However, it should be added that successful partnerships are based on good relations, mutual trust and a strong commitment among the actors involved. It is only when this is achieved that partnerships can be successful and result in benefits that the individual operator could not create on its own. Hallström *et al.* (2014) describes the goal of public-private partnership as effectively managing public investment through co-operation. This is done by carrying out projects with lifecycle perspectives as well as high quality standards. The private actor concludes a contract with a public actor where the private actor is responsible, for example, projection, construction, maintenance or owning and financing a facility for a period of time.

SALAR (2007, p.5) state that PPPs are difficult to define while missing an official definition. They describe cooperation through PPP as;

Public private partnerships bring together a mutual interest and benefit between two or more parties, of which at least one is public and one is private, in a long-term work whose performance contributes to public services

Nelson and Zadek (2000, p. 14) on the other hand describes PPP as;

" People and organizations from some combination of public, business and civil constituencies, who engage in voluntary, mutually beneficial, innovative relationships to address common societal aims through combining their resources and competencies"

These definitions describe PPP as voluntary where actors can create good social and innovative relationships through the coordination of each other's strengths and competencies. These collaborations, and the combination of the actors' strengths, thus enable greater societal issues to be effectively addressed (LaFrance & Lehmann, 2005).

2.4 Public-private partnership in the construction sector

There are several different industries using PPP as a form of cooperation and examples of these industries are the construction industry and other infrastructure (Edmark, 2016). Figure 3 is taken from KPMG (2007, p.4) and describes how the form of interaction can be played out in the construction sector, where ownership and implementation share the figure in two different stages. In step 1, a contract is concluded between a public actor and one or more private actors also known as project companies. The private company is responsible for the construction, financing and management of the facility which is included in step 2 implementation. For example, the public operator may be a municipality or a county and the private operator, who is responsible for the project's implementation, may be a local building contractor or operating contractor.

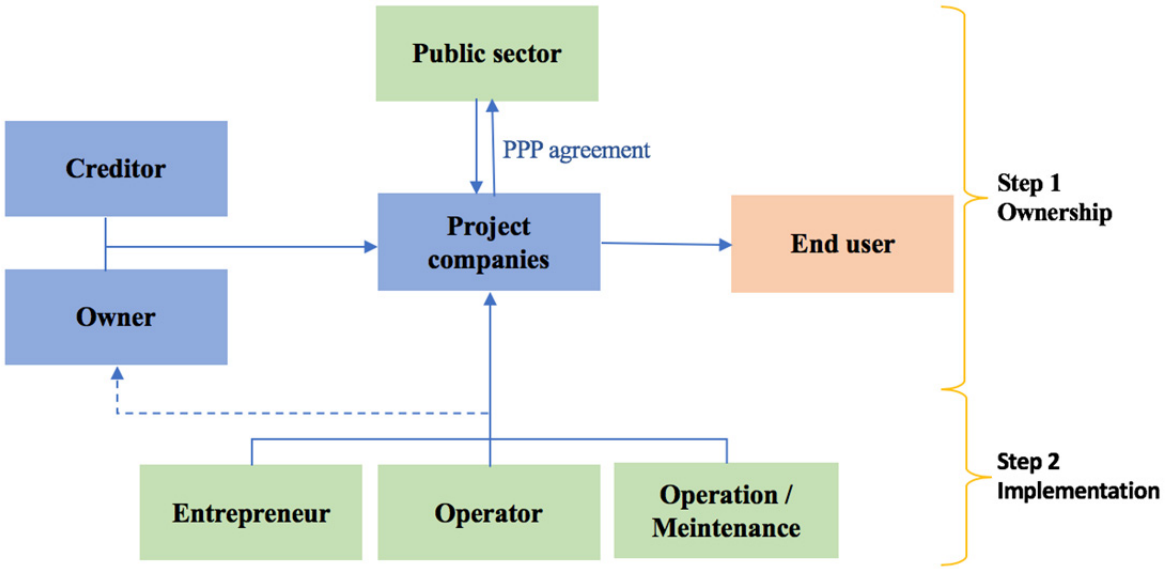

Figure 3. A model of public-private partnership that takes place in the construction sector (KPMG, 2007, p.4).

According to an article from SALAR (2009), so called co solutions, such as PPP, differ in the construction sector from traditional construction projects. One of the differences is that the cooperation often extends over the entire projects life cycle. Here, the importance of clear rules and boundaries is highlighted as crucial for effective cooperation while at the same time identifying the risks in the project for all parties involved. According to Andersson & Siren (2009), the risks in these forms of collaboration are often spread between the various actors in order to streamline the construction project and reduce its life cycle costs. To form an effective cooperation it is described that the risk and responsibility are should be put on those actors who are best placed to meet the requirements. Risks linked to planning and responsibility for different permits usually lie with the public actor, while operational and financial risks are usually transferred to the private actor.

According to Glasbergen (2011), collaboration form lead to the hierarchy between private and public actors shifts from vertical to more horizontal relationships. This method of collaboration implies that, for example, the private actor takes over part of the public actor's responsibility for general issues. Private initiatives and innovative solutions are needed to address major and complex issues while taking advantage of the opportunities that are being developed in the market.

Public-private partnership is described as a living process that extends over a longer time horizon. At the same time, the form of collaboration can be implemented in a number of different areas, which means that different structures about the collaborative form can be designed (Edmark, 2016). There is therefore no existing structure or model of the partnership but only snapshots of the collaboration. According to Magnusson & Nilsson (2008), the PPP type can generally be divided into two types of procurement, institutional and contractual, which are further discussed in this sub-chapter.

2.4.1 Institutional public-private partnership

Institutional PPP is described as cooperation between public and private actors through a separate entity (E-G Commission, 2004). According to Magnusson & Nilsson (2008), this entity can be, for example, an association, foundation or a company and it is this entity that other involved parties sign a contract with. The characteristic of this type of PPP is that

ownership is shared between private and public operator, which means that both actors together are responsible for the different stages within the project. This type of PPP is illustrated in Figure 4 and is used primarily for larger and more complex projects where the public operator can maintain a greater share of control over the project through shared ownership (Magnusson & Nilsson, 2008).

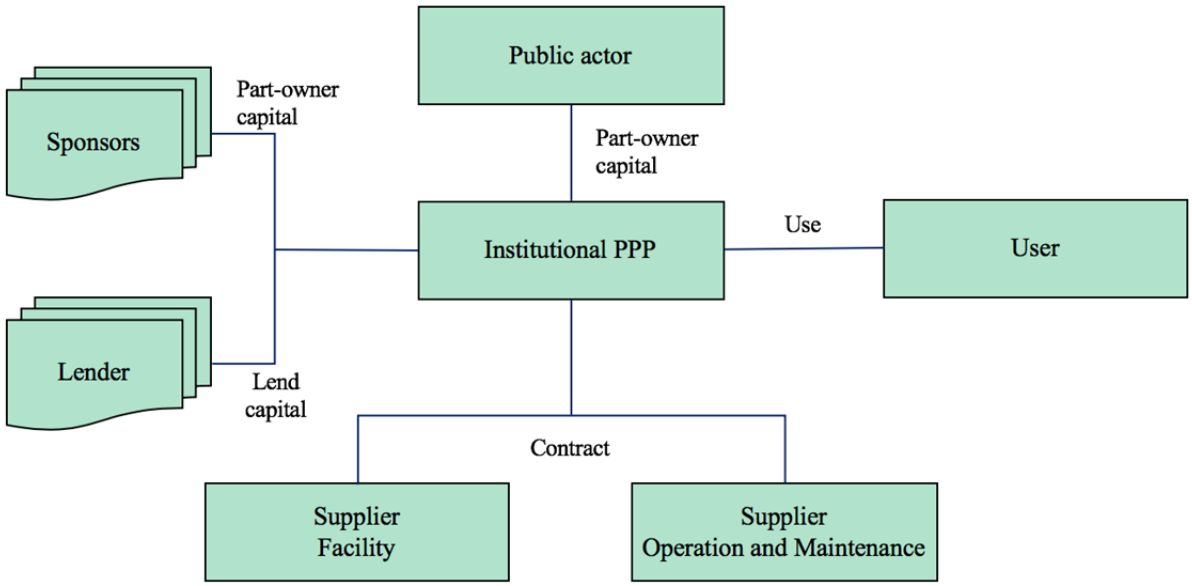

Figure 4. A model of an institutional public-private partnership (Magnusson & Nilsson, 2008. p. 33).

E-G Commission (2004) describes the institutional PPP that;

"According to the view of this Green Paper, the activities of institutionalized PPPs involve the establishment of a unit over which the public partner and the private partner jointly have. The joint entity may then be tasked with monitoring the delivery of a public service or a utility". (E-G Commission, 2004. p. 18)

According to E-G Commission (2004) the introduction of an institutional PPP can be done in two ways. It may be introduced by setting up a unit which the two actors have in common, or the private actor may be part of an existing public enterprise in which the task of the private actor will be to manage and control the enterprise.

2.4.2 Contractual public-private partnership

Contractual PPP is based exclusively on relationships through agreements between the private and public actors (E-G Commission, 2004). In this type of PPP, the ownership structure differs from institutional PPP since only one of the actors in the cooperation is the owner of the project. When the public actor is the owner of the project, ownership is usually transferred to the private actor only when the project is completed and put into operation. Compensation to the private side is through a so-called concession which means that the private operator may use the facility, either part of or all of the facility. In the second procedure, when the private operator is the owner of the project, the establishment is usually handed over to the public party when the contract is completed. In this proceeding, compensation is paid to the private operator for the service carried out by the private operator through the project. The most common form of contractual PPP is the most recent procedure, when the private side provides a service to the public actor which, in this case, has a more supervisory role in the cooperation. In general, contractual PPP is used when the project is of a relatively simple

nature and where contracts without major difficulties can be established between the Parties (Magnusson & Nilsson, 2008). A contractual partnership is illustrated in Figure 5.

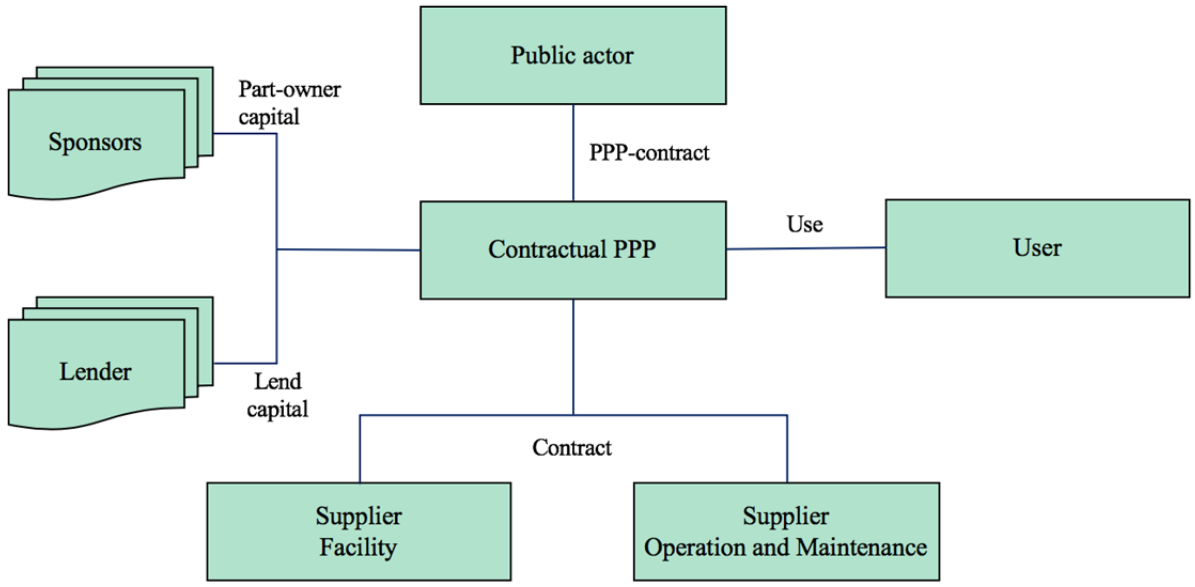

Figure 5. A model of a contractual public-private partnership (Magnusson & Nilsson, 2008. p. 34).

Contractual PPP means that the cooperation is based on agreements and contracts which are formulated at the beginning of the cooperation. This agreement usually gives the private actor greater responsibility for matters involving the implementation, maintenance, financing or design of a project (E-G Commission, 2004). Figure 5 illustrates the partnership between public and private actors in a contractual PPP, which is based on a contract signed between a private and a public actor. As previously treated, there is only one owner of the project in contractual PPP, which is compared with institutional PPP where part-ownership forms the basis of this type of PPP.

2.5 Procurement forms within public-private partnership

PPP, as well as other traditional tenders, are regulated in "*Act (2007:1091) on public procurement"* (European Parliament and council directive, 2004/18/EG). In this type of cooperation's, the procurement phase can be divided into five different procurement forms, which are described as;

- **Open-Procedure procurement.** This form of procurement means that all actors wishing to participate in the project have the opportunity to show their interest and submit a tender for the project (Ibid.).

- **Procurement with selective procedure**. In this form of procurement, all interested actors may show their interest, but only a few actors are selected by the public operator. These chosen actors are then allowed to bid on the project (Ibid).

- **Procurement by negotiated procedure.** In this procurement, the public operator invites a limited number of private operators into discussion. Then there is a negotiation of the project between the public operator and one, or several, of the private actors around the contract terms of the project (Ibid.).

- **Procurement through competitive dialogue.** This form of procurement is described as an option for larger and more complex projects where the public operator is unable to self-determine technical, legal or financial elements relating to a project. In this procurement, interested private actors can discuss with each other in order to arrive at proposals and solutions in order to meet the needs of the public actor. This discussion lays the foundations for the bids that the selected operators can submit (European Parliament and council directive, 2004/18/EG). This type of competition thus helps the public actor to choose between elaborate proposals and tenders from the private operators and, on the basis of the proposals, to choose the tender which best matches the criteria and cost picture formulated around the project (Magnusson & Nilsson, 2008).

- **Procurement through project competition.** Mainly used in areas such as urban construction, rural planning and architecture. This form of procurement means that a jury determines which contribution or tender best meets the requirements and the target image of the project. The participant submitted the grant which best matches with the target image will be the winner of the competition and the tender will be handed over to the public actor (European Parliament and council directive, 2004/18/EG).

2.6 Drivers to enter public-private partnership in the construction sector

There are several driving forces that motivate private and public actors to enter into partnerships in the market. According to Hallström *et al*. (2014) includes an increased need for efficiency, knowledge and improved resource utilization, all of which are described as driving forces to enter into partnerships. In order to create interaction between actors, driving factors or motives are described as important and the cooperation should be capable of delivering something that the individual operator cannot produce on its own.

Through greater responsibility in the market, private companies have gained a broader role in society, while creating the opportunity to deal with complex issues. According to LaFrance & Lehmann (2005) there are different driving forces to enter into partnerships which vary between the different actors. The driving forces are described as closely related to the actor´s individual interests and hence different actors have different driving forces to enter into partnerships.

The private companies usually possess a high level of knowledge and experience in the field in which they operate. They also provide skilled labour, which is usually requested in collaborations. The private actor is profit-orientated which places demands on the collaborations that these should be profitable and successful. Therefore, there is an expectation among private actors that the partnership and the investments made will result in increased returns. Through cooperation, the company can also show responsibility which strengthens its brand against the public and its stakeholders. Hence, the private sector may be tempted to enter into partnerships that can generate higher customer satisfaction and therefore increased returns (LaFrance & Lehmann, 2005). As the private actor is profit-driven, the company is driven to the partnership because of, for example, increased sales, access to a new market or to outwardly take responsibility. In the construction sector, there are a number of talked-about drivers to enter into collaboration where perhaps the most talked about is listed below.

2.6.1 Increased efficiency

When knowledge is added in the form of private actors, the building process tends to be streamlined. The risk associated with the project is often shifted to the private actor, which tends to streamline the construction process. The private actor is profit driven, which leads to a strong awareness of the project's costs. If the project is delayed, it increases the cost to the private operator which he wants to avoid. Hence, these construction projects that are carried out by PPP are rarely delayed as cost awareness is high among the private actors (Åstrand & Sannestad, 2015). Working towards common interests entails support for the public actor in areas such as risk management, contract design and follow-up of the project (Hallström *et al.* 2014).

2.6.2 Financial driving forces

Compensation to the contracted private operator is carried out continuously over the life cycle as long as it lives up to the contracted provisions, such as quality requirements. This provides a security when the costs incurred by the public operator are predetermined and predictable over a longer period of time. The compensation is usually based on the investment, management and financing costs of the project (Hallström *et al.* 2014).

2.6.3 Increased innovation development

Longer contracts can lead to new approaches and an optimization of life cycle cost through technologically innovative solutions. This is made possible by the private actor being responsible for the entire life cycle of the project, combined with increased knowledge transfer. For example, a more expensive choice of materials can be selected if this lowers operating and maintenance costs, which in turn results in a lower life cycle cost. Most studies have investigated the development of innovation that arises from PPP. The results show that innovative solutions in the field of building strategy, financing and organisation of projects emerged from this form of cooperation (Hallström *et al.* 2014).

2.6.4 Spreading risk

PPP implies that the distribution of responsibilities and risk spread between public and private actors. Through the cooperation the risk can be transferred to the operator who is best suited to handle this (Åstrand & Sannestad, 2015). To be able to finance a larger and more capital-intensive municipal project, a shared financing can be the solution. Therefore, collaborations are described as necessary for major projects and which all parties can benefit from (SALAR, 2007).

2.6.5 Soft values

Tackling the so-called soft values as social or environmental issues are other reasons why companies and non-profit organisations want to enter into this type of cooperation. This cooperation increases the added value of a product or service and can thus satisfy many different interests (Bondesson & Erlingson, 2012).

3 Method

In this chapter the reader is presented for the study's choice of approach and how the researcher has proceeded in the collection of data. The chapter concludes with a presentation of the study's respondents and the boundaries that are the basis of the study.

3.1 The objective of the survey

The main objective of the work is to highlight positive effects that are generated through cooperation between market participants and how this partnership can lead to a more sustainable state development in Sweden's cities. The work focuses on wood construction in Sweden and the underlying ambition is to investigate how municipalities through collaboration with private companies can develop a more sustainable urban development in Sweden through increased construction in wood. The aim of the study is therefore not to point out negative effects linked to different methods of collaboration, but instead to point out how these collaborations can enable complex issues to be addressed in an effective way.

3.2 Choice of approach

According to Almqvist *et al.* (2011), three different approaches can be used to obtain information in a scientific study. These different approaches are referred to as a set of steps which are defined as deductive, inductive and abductive approach. Depending on the approach applied in the study, the researcher is guided to different ways of arguing through the work. Differences between these approaches can be described as the order in which they presenting the components *rule, result* and *empiricism* through the work (Hörte, 1998). Figure 6 is a illustrative picture of the different approaches and the differences between these approaches.

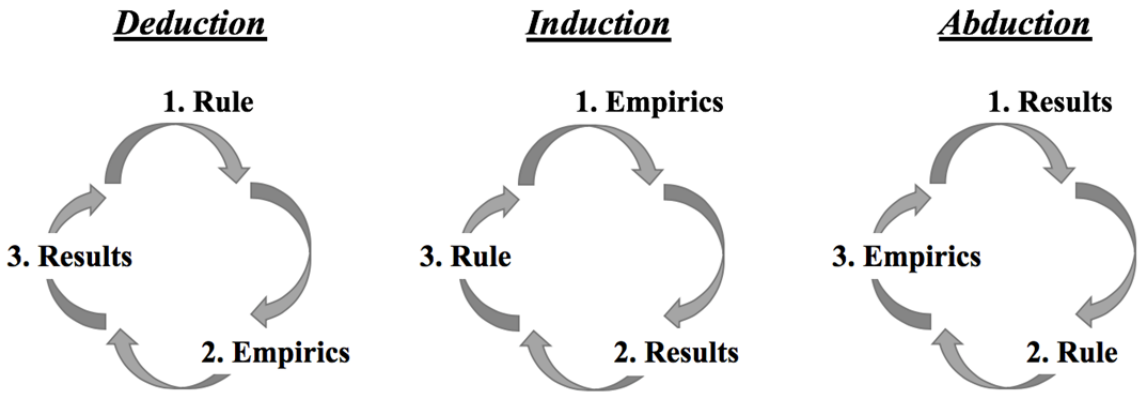

Figure 6. Illustrative picture of the different approaches in research (Hörte, 1998, s.8).

As can be seen in Figure 6, the approaches differ in such a way that they have different starting points in the study and treat rule and empirics differently. The deductive approach starts the argument with a reference to the existing rule or theory. The inductive approach has empiricism as a starting point, while the abductive refers to information obtained in the form of results (Hörte, 1998).

In this study an abductive approach is used which can be described as a combination of deductive and inductive approach. The researcher assumes a specific case and, depending on the information gathered, a hypothetical pattern can be drawn up. In this regard, the researcher

is based on the results of the study to subsequently design a theory that is dealt with through the empirical chapter of the work (Almqvist et al., 2011).

The reason that the abductive approach is used is derived from the fact that the public-private partnership takes place over a longer period of time and therefore only snapshots of the collaboration can be presented. There is no existing theory, since cooperation is constantly changing and evolving in the course of the process. With a abductive approach, the author is given the opportunity to alternately move between theory and empiricism. This means that results obtained from the study can be compared with the theory and empiricism presented in the work. Thus, the Abduktiva approach differs from inductive and deductive approaches as it is based on the results of the study.

3.3 Literature review

The literature survey and secondary data are mainly used as material for the theory and empiricism chapter, but also for the first chapter, Introduction and problem formulation. The Data obtained through secondary sources is located through active search in the scan engines such as the Digital Scientific Archive (DIVA), SLU´s Library and Epsilon. With the help of these search engines, scientific publications, articles and previous research concerning the subject matter and questions of the study can be effectively located. By combining different keywords, the author can delimit the searches from irrelevant literature, which makes the search for relevant and reliable literature more efficient. Table 1 presents some examples of these keywords that have been actively used in search engines and which are combined to localize literature into this work.

Table 1. A display of the keywords used to locate the sources of the study

Cooperation Public-private partnership	Building material Sustainable building	Contractual PPP Institutional PPP
Collaboration	Partnership	Construction
PPP	Procurement	Sustainability
Wood construction	Multi-family housing	Urban development
Housing situation	Construction project	Developer

During the literature review, several different sources have been located and used in the work. These sources can be divided into:

- **Websites and internet-based sources**
  Examples of these sources are debates, news, newspapers, statements and publications from municipalities and government. Internet-based sources are mainly used as material for the introductory and empiricism chapter. Materials taken from these sources mainly concern wood construction and information about Sweden's development towards increased wood construction.

- **Scientific publications**
  Articles, student work and previous research related to the purpose and issues of the study. Examples of these categories that are linked to the study's issues and purpose are: cooperation between market participants, public-private partnership, wood construction and sustainable urban development.

- **Course Literature**
  Primarily used in the introductory, methodological and theory chapters. This course literature mainly concerns the subject of public-private partnership, which is the central part of this study.

These secondary sources are mainly used to provide the reader with an increased understanding of the public-private partnership and how wood construction through this form of collaboration can lead to a more developed and sustainable urban development in Sweden. The secondary data collected through the literature review is primarily dealt with in the introductory, theory and empiricism chapter. Together with the primary data, an analysis and discussion is carried out which aims to answer the study's questions.

3.4 Collection data

Collection of data in the study is done through two different methods, qualitative data collection and literature survey. The collection of primary data is done through qualitative interviews and the results are presented in chapter 5. The primary data is used together with theory and empiricism to design an analysis in chapter 6 and discussion in chapter 7. The conclusions of the study are then presented in chapter 8.

3.4.1 Qualitative Interviews

There are essentially two different methods for the collection of primary data that can be used in this type of study. These are referred to as quantitative and qualitative data collection. A quantitative survey method usually focuses on figures and numbers that can be collected by, for example, surveys or observations. The advantages of this type of data collection are described as cost-effective and that the researcher can reach out to many respondents at the same time through mass survey of questionnaires. Instead, the qualitative survey method uses interviews to collect data. Through these interviews, the researcher can obtain more personal and detailed answers, with the possibility of supplementary questions. This is described as the main strength in the use of this data collection method (Bryman *et al.,* 2011).

The qualitative examination method can be shared into two different categories, structured and semi-structured interview. How the questions are conceived and how these are formulated by the author at the time of interview are described as the difference between these interview methods (Dey, 2005).

The collection of primary data for this study is done through semi-structured interviews with representatives from municipalities in Sweden. The semi structured interview is based on an interviewed schedule and interviews may vary in structure depending on the order in which the questions are asked. Through this kind of interview, the author can easily compare the answers of different respondents, which also facilitates and streamlines the interview and results summary (Bryman, 2011). In this study an interview guide was designed focusing on the study's purpose and issues. Through Semi-structured interviews, the questioner can choose the order in which questions are asked and also have the opportunity to ask supplementary questions to clarify the respondent's answer. Instead of so-called closed questions, which are more precise, the author can start from a specific theme and thereby ask open questions to avoid directing the respondent's response. Therefore, depending on the respondents ' answers, the order of questions may differ slightly between the different interviews (Nilsson, 2017).

Through semi structured interviews the respondent can respond with their own personal answers where the possibility of explanation and development of answers is given. These interviews thus enable personal responses to a complex issue, which is described as one of the strengths of this data collection method and in some cases also the necessary (Denscombe, 2010). Due to the complex nature of the study and the problem background, a qualitative examination method was considered necessary in order to obtain reliable material for the study.

Kvale & Brinkman (2014) describes a qualitative interview as a structured conversation where the questions that are designed are based on a theme or purpose that the researcher has chosen to investigate. Through these interviews, the questioner can get an idea of how a certain group of people relate to certain issues while the follow-up questions can clarify the respondent's response during the interview. In order not to control the respondent, open questions are asked to emphasize personal answers. Depending on the respondent's answer, follow-up questions are formulated to improve understanding of the respondent's response but at the same time to clarify the respondent's attitude to a particular issue. Examples of supplementary questions used during the interviews are: "Can you clarify?" or "Can you tell me more?".

The questions formulated for the interviews were based on the study's purpose and questions. In order to receive detailed personal answers from the respondents, open questions were formulated where the questioner was given the opportunity to ask any supplementary questions that could clarify the answer. Given that the study focuses on a large topic and complex problems, open questions were assessed as the most appropriate method to avoid directing the respondent.

3.4.2 Ethical aspects

Respondents were contacted by telephone where the purpose of the study was presented and the overall issues that the interview was aimed at. In this first interview, the questionnaire went through the length of time the interview was estimated to take and why the municipality was chosen as a respondent to the study. The representative who chose to participate in the interview was booked for a telephone interview.

Before the interview, the purpose of the study was presented again and how the results would be used in the study. At the same time, the respondent was allowed to approve the interview being recorded. The reason that the author wanted to record the interview was based on the streamlining of the interview summary and the summary be done afterwards. Therefore, in order not to miss important parts or phrases from the respondent's answer, the questioner wanted to record the answers. This recording therefore means that the risk of misunderstanding the respondent's response decreases.

After the interview the respondents' replies were compiled and a summary was sent back to the respondent by email. The reason that the interview was sent back to the respondent was to given the opportunity to validate the material that would be used in the study. Through the validation, the respondent can detect any misunderstandings during the interview but also emphasize that the material can be used in the study, so called informed consent.

3.5 Choice of respondents

In the qualitative data collection, 7 different municipalities were selected. The sample for the study was done through active searches in Statistics Sweden (SCB) where the choice of unit was based on the number of completed apartment buildings between year 2013-2017 and 2015-2017. Figure 7 shows the 15 municipalities in Sweden that produced the most apartments in multi-family buildings during the last 3 and 5 years. Through this selection, potential respondents could be contacted and invited to an interview.

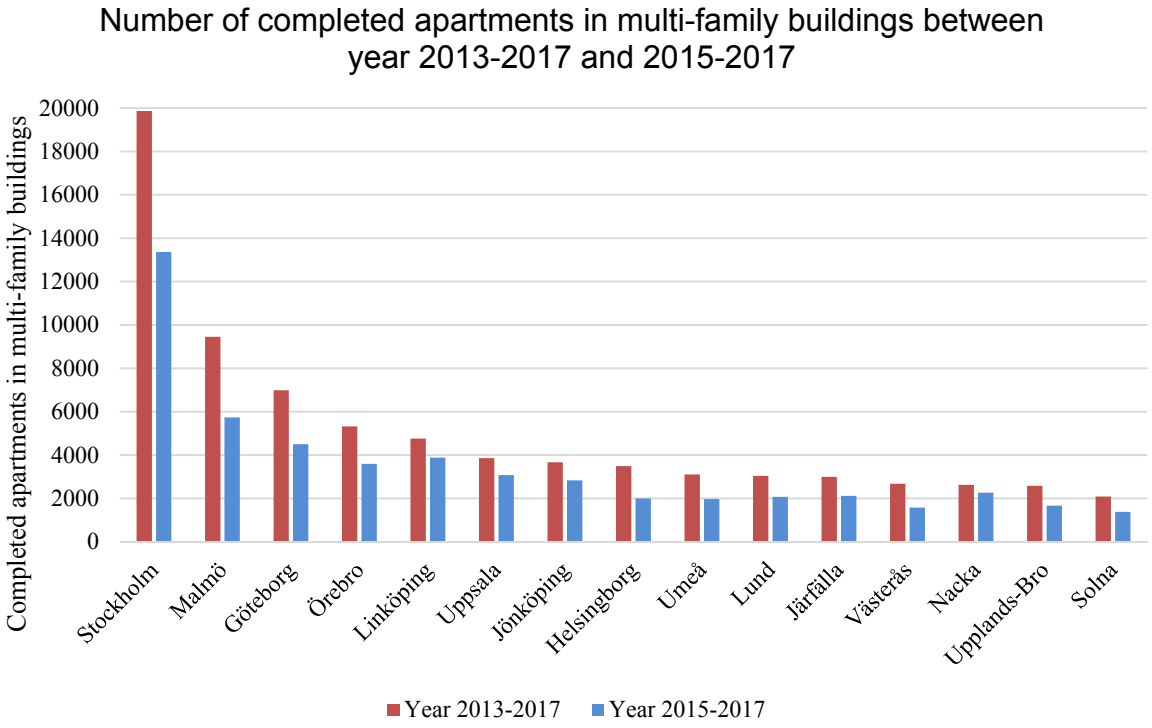

Figure 7. Swedish municipalities that have completed the most apartments in apartment buildings between 2013-2017 and 2015-2017 (Numbers collected from SCB).

The underlying reason that these municipalities were chosen with regard to the number of completed multi-family houses was based on the fact that they are considered to have a great potential for an expanded wood construction within the municipality. Another aspect that was included in the selection of the respondent was that the municipalities that produce the most apartment buildings are expected to have a good insight into all the complex issues that the study are being focused on. In the study, some municipalities were removed, which was based on the difficult access of representatives in these municipalities. The respondents are located in a first stage through searches on the municipality's websites. In cases where the representatives have not disclosed their contact information on the municipal website, there were difficulties in getting in contact with them. In cases where no contact information was provided through the website, the municipality's telephone exchange was contacted, which in turn referred to an email address to the representative. In these cases when mail with an interview request has been sent to the representative, the response rate was very low. The municipalities included in the study and who chose to participate in an interview are shown in Table 2.

Table 2. Shows a summary of the municipalities that are included in the study

Municipality	Respondent	Interview form	Date of interview	Date of quality assurance (validation)
Örebro	Toro Hartman, C	Telephone	2018-05-16	2018-05-30
Solna	Svenonius, T	Telephone	2018-05-16	2018-05-29
Uppsala	Hollinder, A	Telephone	2018-05-16	2018-07-09
Västerås	Kallsäby, L	Telephone	2018-05-28	2018-06-20
Umeå	Berg, U	Telephone	2018-06-20	2018-08-06
Linköping	Wiklander, J	Telephone	2018-06-20	2018-08-29
Malmö	Nellerup, J	Telephone	2018-06-28	2018-08-06

Table 2 shows the date of interview and when the respondent returned with an approval of the interview compilation. After the interview, all responses were compiled and sent to the respondent by email for approval. In this email contact, the respondent was able to reconnect with opinions about which material could be used in the study and if the respondent wanted to add something that was missed during the interview. This subsequent email contact is considered important, partly for the approval of the material, but also to give the respondent a chance to clarify answers which limits the risk of misunderstanding of the result.

3.5.1 Presentation of respondents

The respondents main task and main area of responsibility are presented in Table 3. The table also presents the municipality in which the respondent is active.

Table 3. Presents the study's respondents as well as their main duties and responsibilities within the municipality

Municipality Respondent	Main task /Main area of responsibility
Örebro Municipality ***Toro Hartman, C***	• Chairman of the building board • Member of the program committee community building • Member of the city council
Solna Municipality ***Svenonius, T***	• Municipal councillor, Solna municipality, with the main task of being chairman of the municipal construction committee. • Also in the municipal council and as a member of the city council.
Uppsala Municipality ***Hollinder, A***	• Worked at Uppsala municipality since year 2009 • Urban management - strategic planning, strategic social planner with energy as the main focus. Educated energy engineer. • Have been involved in developing an energy program for sustainable urban development. • Worked with the field guidance process in Uppsala Municipality since 2010.
Västerås Municipality ***Kallsäby, L***	• Municipal council, centre party • Responsibility for the building committee, city building office. Responsibility for overview planning, detailed planning and building permits. • Is a member of the municipal council and city council.

Umeå Municipality ***Berg, U***	• Vice-Chairman of the building board. Been in the Umeå Municipality construction committee for 19 years. • Had environmental issues in focus and have among other things been involved in the formation of a "network for sustainable building in cold climate" 10 years ago. The network is aimed at trying to get the industry to think in other ways, on a voluntary basis. The main focus of the network was to investigate how much resources are spent on each property and how much resource you can recycle when the building is demolished.
Linköping Municipality ***Wiklander, J***	• City architect. Member of the environmental and social housing management where issues involving physical planning and technology are addressed. Within this administration there is a detailed planning department, overview planning department, exploitation department, municipal surveying, environmental office and building permit office. • Position directly under the environment and public works director to be a strategic recourse, but also to work with the administration´s different offices within the municipality. • Main task: monitor and develop quality work within the municipality. This includes partly what the municipality itself builds (streets, squares, parks, etc.) but also to help and stimulate "as high quality as possible" on the projects that the market and industry performs within the municipality. • Also works to discuss and stimulate a higher quality in public construction. Has been a project manager for the Linköping City's architectural program, which is an addition to the municipality's overview plan, which deals with how to achieve a higher quality in what is produced in the future.
Malmö Municipality ***Nellerup, J***	• Urban building office, urban planning strategy • Work with national assignments and projects. Working with environment monitoring and to further develop Malmö's urban idea and focus.

In this study, respondents were chosen who could answer more complex questions such as collaborations as well as choice of materials linked to major construction projects. All respondents are currently active in a municipality and their duties are linked to major construction issues, which can be read in Table 3 above.

3.6 Processing data

Results from the semi-structured interviews are compiled in an interview summary that was then sent to the respondents for approval. In this way, a validation of the interviews is made to strengthen the study results. The results of the interviews are presented in Chapter 5, Results, and are then used as the basis for analysis and discussion together with empirical and theory.

The result is presented in continuous text with a similar structure as in the interview guide. Respondents' answers differed slightly as the author considers to be positive for the outcome of the study. Differences between respondents' responses are highlighted in the chapter of the results and discussed in the analysis and discussion chapter. In the various interviews, the questions were put in a similar order where the structure can be seen in Appendix 1. By asking the questions in somewhat the same order, depending on the respondent's answers, the study's results could easily be compiled and at the same time differences between respondents' responses could be highlighted.

The analysis chapter (Chapter 6) deals with the results obtained through the interviews and secondary data there finding are compared with the theory presented in Chapter 2. When the interview was prepared, the researcher was based on existing theory in the field, but also from the research questions and the purpose of the study. Therefore, the result can be easily dealt with in a analysis and discussion.

3.7 Quality assurance

To ensure the quality of the study and its results, it is necessary that the researcher is aware of the credibility of the sources used in the study, but also the credibility of the material from the interviews conducted. This subchapter describes thus the researchers perceived credibility regarding the information gathered, the results of the interviews and how different sources were used in the work.

3.7.1 Secondary sources

Secondary data may vary in credibility depending on what source they are derived from and how they are presented. Therefore, the author needs to be able to sort data and use a certain critical attitude to websites and internet-based sources. For example, on the municipalities and company websites, the marketer chooses what is presented to its stakeholders, thus requiring some caution about how these can be used. Information gathered from these sources is mainly used for introduction, background and discussion, though with some caution because of its credibility. Sources such as scientific Publications, articles and previous research are dealt with in this work as credible sources. These have been downloaded from trusted search engines which is one of the reasons why these sources are considered reliable.

3.7.2 Primary data from interviews

Due to the complex issues of the study, representatives of the building committee were elected in each municipality. These representatives have a strong connection to major construction projects within the municipality and the municipality's approach to these projects. Hence, these actors were considered best placed to answer the questions of the interview guide. This means that the interviews are judged to reflect the reality in a satisfactory manner and that the results of the study have high credibility.

After the interviews, an interview summary was sent to each respondent. This step in theprocess means that any misunderstandings that arise during the interview can be clarified and the respondents may agree that the material is used in the study. In this email contact, the respondent can also clarify or develop their responses from the interview to clarify if something is missed. At the same time, during the interview, there was an oral validation in the form of supplementary questions asked by the questioner in order to clarify the respondent's answer. Through these follow-up questions, the understanding of the respondent's response increased, while the respondent was given the opportunity to further develop the answer.

3.8 Delimitations

In order to direct work towards its purpose and questions it is necessary to define the work. By delimiting the study, the author can effectively target the collection of data, thereby locating relevant material. The delimitations that are made in the work can be divided into empirical delimitations, data collection methods and theory delimitation.

3.8.1 Empirical delimitations

This work focuses on the construction industry in Sweden. Wood construction is a large concept of a relative that can include both multi-family houses and single-family houses. This study focuses on major municipal projects, such as multi-family houses and other major construction projects. The reason for this delimitation is that a large part of Sweden's single-family houses are already built in wood material today, compared to multi-family houses where steel and concrete are clearly dominant. It is therefore of great interest in this study to investigate municipalities' views on building materials wood in multi-family houses where the potential for choosing this more climate-friendly and renewable material is large.

Public-private partnership can be used in a variety of business areas, usually within the construction industry, healthcare or infrastructure. This form of cooperation is usually used to transfer part of the public operator's responsibility to one or more private actors. In this study, public-private partnership is limited to the construction sector in Sweden. The work focuses on major construction projects in Sweden where cooperation occurs between the tax-financed municipality and the profit-making private developer.

The work deals with the perceived advantages and disadvantages of the partnership form Public-Private partnership. By separating the study into the construction sector in Sweden, other perceived advantages and disadvantages can be found with the form of collaboration in other areas of activity, but these are not addressed in this study.

3.8.2 Method-related delimitations

The data collection takes place partly through a literature survey of previous reports, studies and articles relating to public-private partnerships and through qualitative interviews with 7 different municipalities in Sweden. The collected data from the literature survey are presented in the theory and empirical chapter. Results from the qualitative interviews are presented in the results chapter. The collected data will then be compared and discussed in an analysis and discussion chapter, and then formulate the conclusions emerged from the study in Chapter 8, conclusions.

To this study, the municipalities that have completed most of the apartments in multi-family houses in the last 3-5 years have been chosen. The selection of qualitative interviews takes place through active searches in the Statistical Office, which means that many municipalities are delimited from the sample. In order for the respondent to be able to answer questions about cooperation in the construction sector, but also about wood construction, the assessment was made to focus the interviews with representatives in the municipality's building committee. Hence, delimitations within the municipalities were also made to try to increase the quality of interviews conducted.

The main literature and data used in this work concerns the public-private partnership. As mentioned earlier, this form of cooperation can be applied in a number of different areas of activity, and the data collection is directed towards such articles dealing with public-private partnership in the construction industry. Articles, debates and other literature directed towards wood construction in Sweden are used to gain an understanding of the advantages and disadvantages of wood as a building material. Literature related to the history of wood construction is also used to increase understanding of the historical development of society towards a more sustainable development.

To obtain material and data for the theory and empirical chapter, various search engines such as SLU's student library, Epsilon and the Digital Scientific Archive (DiVA) are used.

3.8.3 Theoretical delimitations

As mentioned earlier, collaborative forms can be implemented in a number of different areas of activity. Therefore, the theory of this study is mainly limited to public-private partnership in the construction industry in Sweden. One of the reasons why the areas of activity for this form of collaboration are delimited in the theory chapter is that the perceived advantages and disadvantages of public-private partnership may vary depending on the area in which the form of cooperation is applied. Different actors' motives for collaborating may vary depending on the area in which the collaborative form is used. It is therefore important to delimit the theory in order to direct the material towards the purpose and the questions of the study.

The theory chapter presents three different models for public-private partnerships and a figure that illustrates the development of cooperation. These models and figures are used throughout this work and lay the foundation for the study's analysis and discussion chapter.

4 Background for the empirical study

The empirical chapter begins with giving the reader an overall picture of the housing situation in Sweden. Then the development of wood construction in Sweden is presented and the perceived advantages and disadvantages of wood construction. The material from this chapter is discussed in the analysis and discussion chapter together with the presented theory and the results from the interviews.

4.1 European Union climate change objectives

The European Union (EU) has formulated long-term goals to address the current global warming and climate change. The EU has therefore developed different frameworks that will guide the development towards lower greenhouse gas emissions, increased energy efficiency and expand renewable energy (Swedish wood, 2018). Today there are three different frameworks where targets for the years 2020, 2030 and 2050 are formulated.

Climate targets for the year 2020;

- Reduce greenhouse gas emissions by 20% compared to year 1990
- Increase renewable energy by 20%
- Increase energy efficiency by 20%

Climate targets for 2030;

- Reduce greenhouse gas emissions by 40% compared to year 1990
- Increase renewable energy by at least 27%
- Increase energy efficiency by at least 27%

The European Parliament also pursues the issue of raising these targets and has proposed to increase the renewable energy target from 27% to 35%, as well as the Energy efficiency goals (Government Offices of Sweden, 2018).

The climate target for year 2050 is to reduce greenhouse gas emissions by 80-95% compared to the year 1990 (Swedish wood, 2018).

The construction sector, as well as other areas, is affected by these new directives both in the production of building materials and in the operation of construction projects. These climate targets increase the demand for energy efficiency, renewable energy sources and alternative building materials that can contribute to reduced climate emissions from the construction sector. The homes established must be resource- and energy-efficient to reduce environmental impact throughout the building's entire life cycle. Therefore, wood is described as an alternative building material in the construction sector in order to meet these new climate targets (Swedish wood, 2018).

4.2 Housing situation in Sweden

In recent years, the population in Sweden has steadily increased. This in combination with the fact that housing production has not reached the same level as the population increase has led to a growing housing shortage in the country. Housing shortages are estimated to vary across the country's different municipalities, which will lead to varied increase in housing production in response to demand. In the metropolitan regions of Stockholm, Gothenburg and Malmö, housing construction is expected to increase significantly over the coming years to meet the current housing shortage in the country (NBHBP, 2018b).

NBHBP performs a housing market survey every year to form an idea of the current housing situation in Sweden. In this annual survey, municipalities in Sweden participate, where each individual municipality is allowed to answer how they experience the housing situation. According to the housing market survey in 2018, the survey was answered by 288 of Sweden's 290 municipalities. According to the survey, 243 municipalities report that they are facing a current deficit of housing within the municipality (NBHBP, 2018b. s.21) which can be compared with 2017 annual survey results where 255 described a perceived deficit of housing (NBHBP, 2017. s.20).

According to NBHBP (2018b, s.5) the need for new housing is estimated at 66,900 per year until 2025. NBHBP, however, estimates that the construction of new housing has not reached this estimate, which contributed to the fact that this housing deficit has grown in Sweden since 2012. This in combination with an increasing and varied population development in recent years, the forecast varies over time until 2025. The estimated forecast of population development as well as the need for new housing until 2025 is shown in Figure 8.

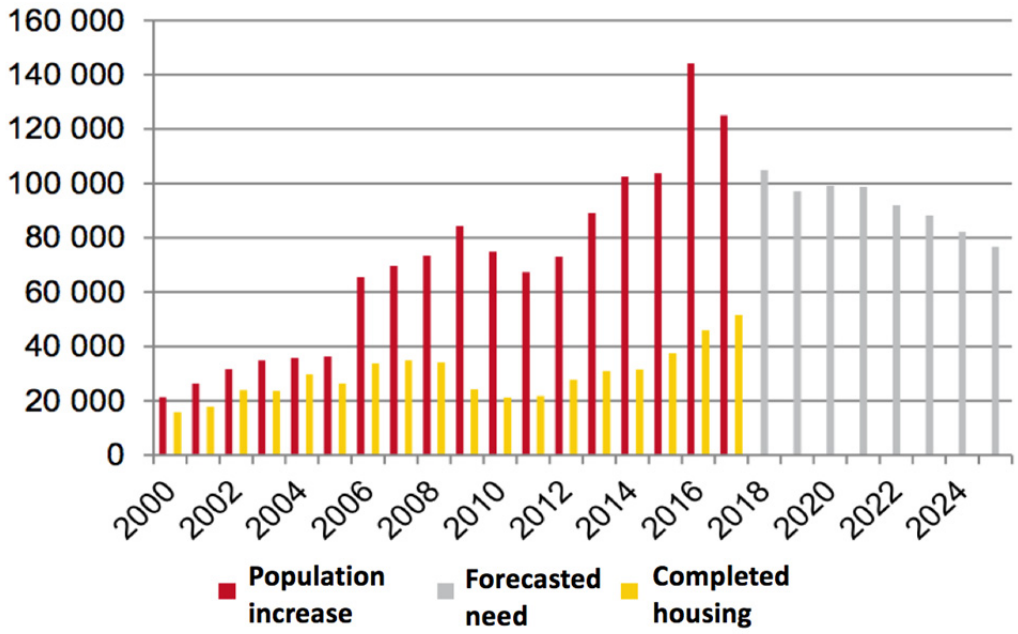

Figure 8. The relationship between completed housing and the forecasted need for housing up to the year 2025 (NBHBP, 2018b. p. 5).

As described in NBHBP (2018b) compilation and forecast, production of housing needs to increase significantly over the next few years. According to NBHBP´s assessment, 93.000 completed homes are required per year between 2018-2020 (NBHBP, 2018b, p. 20).

In 2017, 51.500 new homes were completed in Sweden, which is the highest listing since 1992 (SCB, 2018a). Figure 9 shows the number of completed apartments and single houses in 2017. These figures can be compared with 2016 when 42.441 homes were produced (SCB, 2017).

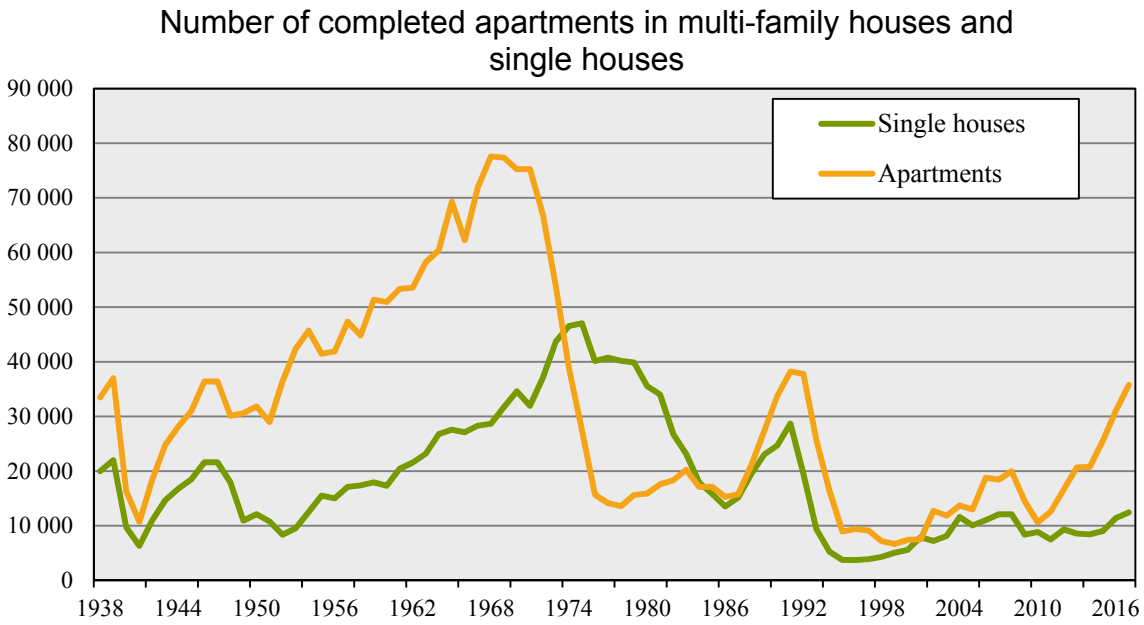

Figure 9. Shows the number of completed apartments in multi-family houses and single-family houses from 1938 to 2017 (SCB, 2018b).

In 2018 and 2019, 120.000 homes are expected to be completed, which is far from the forecasted need of 93.000 homes per year. Therefore, housing shortages in Sweden may increase over the next few years (NBHBP, 2018b).

4.3 Wood construction in Sweden

Since 1994, it has again been permitted to use wood as a bearing material in multi-family houses in Sweden. According to Nord & Brege (2013), this ban has had major consequences for the construction industry. The ban on the use of wood as building materials has meant that knowledge and experience has become a limiting factor for wood construction in Sweden. Concrete has in turn been the market leader for a long time, which resulted in the builders having incorporated working methods associated with this material. Therefore, local skilled labor is described as a limiting factor for today's wood construction.

In 2002, the Ministry of Enterprise and Innovation presented a proposal to develop a strategy for increased wood construction in Sweden, "More wood in construction DS2004:1". Interest from the state was based on increasing competition in the construction industry by promoting increased use of wood as building materials. This strategy was expected to produce innovative wood construction products and make Sweden a leader in wood construction. The strategy was developed to meet the complex urbanization issue in the country while the government demanded sustainable state development through increased timber construction. The government's interest was based on developing products and systems to better establish wood as building materials in the market where steel and concrete have long been the market leader (Ministry of Enterprise and Innovation, 2004).

The interest in using wood as building material has recently increased and the Ministry of Industry in Sweden has presented a document "Focus on wood construction" in 2018. The Government Offices of Sweden describe through the document a positivity about the market's growing wood construction. In this document, innovative companies, municipalities, architects and forest companies are described as the actors who pushed for the development of

an increase in wood construction in Sweden. The government describes that they are positive about this development, as described, creating new jobs, technical development and increased housing production. Most of Sweden's land area are covered by forest, which provides good conditions for expanding its market in the construction and forestry sector. The background to the Ministry of Industry's choice to encourage increased timber construction is based on Sweden's current housing shortage, but above all in order to address the environmental impact deriving from the construction sector (Government Offices of Sweden, 2018). This ongoing discussion about the environmental impact of the construction industry has led to an increasing number of countries and governments starting to focus on alternative materials such as wood for major construction projects (Swedish wood, 2018b).

According to statistics from SCB (2018b), 35 782 apartments were produced in Sweden in 2017. Figures show that wood construction accounts for 10% of all these completed apartments in multi-family houses produced in Sweden each year. Historical figures linked to the number of apartments produced in multi-family houses with wooden frames are illustrated in Figure 10.

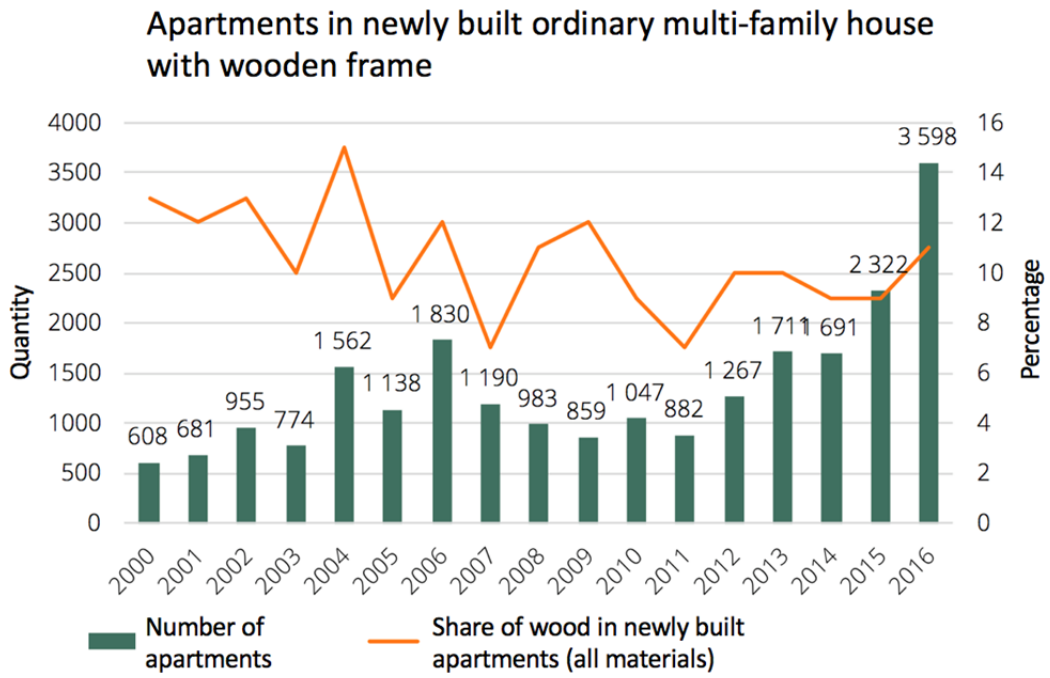

Figure 10. Historical figures of the number of apartments produced in multi-family houses with wooden material. The figure also shows the percentage of apartments that are used with the wooden material (Government Offices of Sweden, 2018, p.9).

According to SCB (2018b), 3.598 apartments were produced in newly built multi-family houses in the wood frame material in 2016. It should be added that between 2015 and 2016 the number of apartments produced in multi-family houses, built with wood material, increased by 50%. These figures show that the wood industry keeps pace with the other housing construction in the country. The percentage of apartments produced in multi-family houses, with wood material, has increased slightly in recent years. This is due to the fact that the production of housing has grown sharply in recent years in the market attempt to meet the current housing shortage and population increase in the country (TMF, 2017).

4.4 Wood as a building material

According to SALAR (2013) wood is described as a renewable material that acts as a carbon sinks in nature. Through the tree's photosynthesis, carbon is stored in the wood at the same time as oxygen is produced. Therefore, wood is described as a more climate-friendly building material compared to other competing materials such as steel and concrete. In order for wood as a building material to continue to be described as long-term sustainable, the importance of sustainable use of Sweden's forests is a prerequisite SALAR (2013). Today, the use of Sweden's forests is regulated by the Forestry Act. According to the Forestry Act (1979:429), the forest is to be used so that it can generate a good return for future generations, while maintaining biodiversity. The laws are based on the long-term sustainability of the forest, taking into account nature, culture, river drainage, recreation and many other interests that the forest generates. The Forest Act (1979:429) requires that the landowner must replant forest after harvesting, if the productive land is untapped or if the condition of the forest is unsatisfactory with regard to the potential of the soil.

According to SCB (2018b), about 10% of all new production of apartments in multi-family houses produced are built in the material wood. Since year 1994, when it was once again allowed to use wood as building material in multi-family houses, this material has grown in popularity. Wood as building material has both advantages and disadvantages, which are further discussed in this chapter.

4.4.1 Advantages experienced of wood construction

According to Swedish wood (2018a), wood is described as the only building material that is renewable on the market. This is described as a major competitive advantage, as today's discussions show an increase discussion about environment and sustainability, while municipalities and governments are demanding increased wood construction. Through this renewable material, increased responsibility can be developed within the construction industry while meeting environmental goals.

An increased wood construction is described, in addition to its climate benefits, generating faster and cheaper construction processes while providing more jobs in rural areas (Hult & Olsson, 2017).

Renewable and climate-friendly
Forest is described as a renewable resource. Renewable means that the resource is not finite. Forests can be harvested and by replanting and other management measures, new trees can be harvested in the same area in the future. The sustainable use of Sweden's forests thus entails an invaluable resource that does not run out and has many uses. Another advantage of wood as a building material is that wood binds carbon dioxide during its growth and photosynthesis. Coal is stored in the wood, which means that forest acts as a natural carbon sink in nature. To maximize the carbon dioxide uptake of the forest, high growth is required, which is described correlated with optimal care of Sweden's forests. Wood as building materials is therefore described as more climate friendly compared to other competing materials such as steel and concrete (SEPA, 2017).

During the last two decades, rapid development in the construction sector has been achieved by increasing competition in the market, while at the same time meeting the EU's climate targets. Through the wood industry, sawn timber and building materials can be produced at significantly lower energy consumption compared to, for example, concrete such as a

significant advantage in today's energy and climate-oriented markets. Most of Sweden's sawmills use biofuel for their production, which is produced from the production's own by-products in the form of bark and shavings. According to Swedish wood (2018a), 80% of the sawmill's energy is produces by the biofuels constitutes, the remaining 20% of electricity (Swedish wood, 2018a).

According to Brege et al. (2017) describes wood construction to reduce climate emissions by 40% during construction phase compared to competing materials such as concrete. Furthermore, the production of wood material is described as requiring significantly less energy for manufacturing. In order to measure the energy utilization of a building and to compare different building materials, an analysis method called "Life Cycle Analysis" (LCA) is usually used. Through this measurement method, the environmental impact of the product can be measured throughout its life cycle, from manufacturing to waste, with regard to all influencing factors (Andersson, 2016).

In a study by Larsson *et al.* (2016) investigates the climate impact of a new construction of a solid wood house with regard to carbon dioxide emissions and energy consumption. The study is based on a Life cycle analysis where all different factors are included and the housing's continued maintenance and energy consumption in 50 years onwards. According to the study, the construction phase of 163 kg CO2 eq/m^2 Atemp corresponding to approximately 38% of the total climate impact of the buildings entire life cycle. Of these 163 CO2-eq/m^2 Atemp, production of materials was 78%, ground work 8%, transport 6% and construction production 8% (Larsson *et al*. 2016. p. 36).

Compares the study by Larsson et al. (2016) with another similar study by Liljenström et al. (2015), where a life cycle analysis was carried out on a major construction project in concrete, it appears that the climate impact of the various construction projects differs significantly.

Climate impact during the construction phase of the concrete building amounted to 359 CO2-eq/m^2 Atemp seen over the building's 50-year life cycle. Of these 359 CO2-eq/m^2 Atemp material production accounted for 84%, transport 3% and construction process 13%.

Summary image of the study performed by Larsson *et al*. (2016) and Liljenströms *et al*. (2015) are presented in Table 4.

Table 4. Comparative table of two previous studies examining the environmental impact during the construction phase of wood and concrete as building materials. Figures taken from Larsson et al. (2016, p. 52)

	Construction project with wooden frame (Larsson *et al.* 2016) CO_2-ekv/m^2 A_{temp}	**Construction project with concrete frame (Liljenströms *et al.* 2015) CO_2-ekv/m^2 A_{temp}**
Production of materials	134	304
Transport	12	12
Construction phase	18	43
Total	**163**	**359**

Compared to these construction projects, it is noted that during the construction phase, the different materials are different in terms of greenhouse gas emissions. It is significantly higher energy consumption in the construction of concrete and thereby has a greater environmental impact in terms of carbon emissions. Both of these studies use life cycle analysis and have investigated the same climate factors which have made these studies comparable. According

to Larsson *et al.* (2016) The choice of electricity plays a significant role in building greenhouse gas emissions as energy consumption is highly correlated with fossil emissions.

'Swedish concrete' describes in Hult & Olsson (2017) that concrete houses do not differ significantly from wooden houses viewed from a life-cycle perspective (Hult & Olsson, 2017). However, both the research and the comparison between the studies from Larsson *et al.* (2016) and Liljenströms *et al.* (2015) show that wooden houses generate a significantly lower climate emission over the entire life cycle of the building.

Prefabrication

Wood as building materials has many different advantages, one of which is described as the possibility of prefabrication. Prefabrication means that parts of the building, also known as modules or building elements, can be manufactured in a controlled environment such as a factory or production facility. By prefabrication, the building's parts and frames are manufactured along production chains and then transported to the construction site for assembly. Industrial construction thus entails an efficient construction process, where fewer hours are required at the construction site, while costs in the production phase decrease (Nilsson, 2017). According to Mohammad & Youssef (2012), the construction industry is described as an accident blackspot where the risk of injury is imminent. At construction sites there are risks associated with high noise levels, exposure to dust, fall accidents and heavy lifting. Prefabrication transfers the production of building elements into a controlled factory environment, which describes improve the working environment significantly (Mohammad & Youssef, 2012). In a factory, noise levels can be reduced, production becomes energy efficient and the amount of heavy lifting is reduced. Reduced dust exposure and fewer hours of work on dangerous ladders and stands are other advantages that prefabrication results in compared to traditional construction (Nilsson, 2017).

According to Government Offices of Sweden (2018), an increased production of industrial construction in Sweden is requested. This method of production of residential buildings is described as accelerating the construction process while costs for new housing are decreasing and quality is improving. Through industrial construction, the construction phase is moved from the construction site to a factory that is usually located outside the metropolitan areas. This explains prefabrication to create more jobs in rural areas while reducing the impact in the metropolitan areas (Government Offices of Sweden, 2018). According to Brege *et al*. (2017) reduces the population of Sweden's rural areas, which is a result of the strong urbanization in the country. By prefabrication, the production of residential housing from the cities to rural areas is shifted, which leads to a more even employment rate between town and country. When the construction process is moved to a controlled factory environment, the workers' profile is also changed, from carpenters to machine operators. This is described as facilitating wider recruitment of labour while creating more work opportunities for those living in rural areas.

When the building elements are produced, they are moved to the construction site for assembly. This assembly is described as effective where fewer hours are needed at the construction site compared to traditional "on site" construction. Therefore, housing construction is described through prefabricated modules, partly reducing the disruption around the construction site, while less working hours are needed at the place where the building is to be established (Nilsson, 2017).

Another important aspect of wood construction is the risk of moisture damage. Wood is described as a living material where moisture can damage the building material at both transport and at construction sites. An advantage of prefabrication is that the production of building elements takes place in a controlled environment, however, the material needs to be protected and avoid exposure to rain and wind. However, it should be added that prefabrication results in a faster and more efficient assembly which requires fewer hours at the construction site (Nilsson, 2017).

When the construction time becomes shorter and costs are reduced, there is an opportunity to manufacture more buildings for a shorter period of time. This is described as a major advantage of wood as building material and prefabrication as housing shortages in Sweden grow (Brege *et.al*, 2017).

Physical characteristics
Wood is a lightweight material that can carry heavy weights in relation to its weight. This entails a possibility of prefabrication and cheaper transport compared to other competing materials. Wood as a building material is also described to be used for, for example, extensions of existing buildings or for construction in places previously considered non-buildable. The material thus provides an opportunity to develop cities and become more dense and that existing buildings can be built higher (Svensson, 2015).

According to the SALAR (2013), wood as building materials entails developing new methods and working methods in the construction industry. The physical properties of the material make it possible to streamline the construction process and reduce the ineffective on-site construction with steel and concrete (SALAR, 2013). An important and distinguished feature of wood is that the material is flexible where changes can be made late in the construction process. This is a noted disadvantage of other building materials such as concrete where changes during the construction process become more complicated and comprehensive (Roos *et.al*, 2009).

4.4.2 Disadvantages experienced of wood construction

Wood as building materials brings many benefits, such as climate benefits, improved work environments, and the material enables a faster and more efficient construction process. However, there are some distinct disadvantages of wood as building materials. Roos *et al*. (2009) believes that knowledge and experience are two important factors in reducing the resistance of wood as building materials. Hence, increased knowledge is needed to meet challenges while developing techniques and methods to reduce the disadvantages of building materials.

Sound insulation between floors
According to Roos *et al*. (2009), the soundproofing capacity of wood is mentioned as a disadvantage compared with concrete, especially between different floors in high-rise buildings. This means that methods and techniques must be developed to reduce these noise levels and increase the sound insulation ability. According to Research & Progress (2009), larger beams are usually used between floors with rubber strips to reduce the experienced footsteps of the residents.

In the development of Sweden's cities, according to Giang & Moroz (2013), it is common for buildings to be established in high noise areas, next to railways or highways. This requires great demands on the sound insulation capacity of today's buildings, especially in the big

cities. This is a challenge in today's wood construction as the sound insulation differs significantly from concrete buildings, for example. To meet these challenges and reduce the sound transmission in existent wooden buildings, new methods and techniques have been developed. Bigger beams in combination with the separation of the floor and ceiling construction is a well-known method that results in a reduced noise transmission between different floors. Different insulation materials are also developed while air slots in the walls can be used to reduce the noise transmission between apartments and rooms. However, there are major differences between wood and concrete as building materials, especially when soundproofing is discussed. Therefore, new technologies and methods need to be developed in timber construction to meet today's sound requirements while competing with other materials such as concrete.

Stability

A great advantage of concrete buildings is its stability. Stability is described as a major competitive advantage in selecting building materials for high-rise buildings. In order to build stable wooden houses, coarse dimensions of bearing beams are required to cope, not only the stability requirements, but also the requirements for step noise and fire limit (Blom & Thored, 2016).

According to Hellsborn & Nilsson (2010), concrete and steel have a density of 2.300 kg / m^3 and 7.800 kg / m^3, while wood only has a density of 500 kg / m^3. Thus, a larger volume of wood is required if this material is to reach the same strength as steel and concrete. However, it should be added that concrete weighs considerably more than wood, which means that the volume of building materials in high-rise buildings does not differ to the same extent as the density of the material. Buildings are affected primarily by horizontal winds, which means that the building's weight affects its stability. These horizontal winds thus mean that a stable ground plate is a must in the construction of high-rise buildings. Using a concrete base for wooden building construction is therefore common to increase the stability of the building.

Fire resistance

Wood as building materials is described as more predictable in a fire process compared to steel and concrete that can collapse without warning. Concrete is classified according to the building as a non-combustible material as opposed to wood classified as a combustible material (Afshar & Alaoui, 2016).

According to Svensson (2015), it is described that wood as building materials is more predictable during a fire compared to concrete, while different construction structures of today's wooden houses make these highly fire resistant. Fire safety in residential buildings is very important and a strong criterion for the selection of building materials. According to Hellsborn & Nilsson (2010), the fire hazard in the wooden building was the reason that high-rise buildings in wood were forbidden in Sweden. Today there are three different fire classes for buildings that are classified in Classes 1, 2 and 3. For high-rise buildings that are over three floors and used as apartment buildings, construction must be carried out after fire class 1 which is the strictest of these three classes. In this class there are clear requirements for the fire function in the supporting part of the building and on the walls to separate the fire cells (Hellsborn & Nilsson, 2010).

Moisture

Wood is an organic material that is at greater risk of being attacked by fungi and insects compared to concrete. This is described as a major disadvantage for wood as building

materials. Wood can be broken down by microorganisms, and the material must be treated and stored properly (Giang & Moroz, 2013). According to Afshar & Alaoui (2016), moisture damage in wooden houses can reduce the construction and carrying capacity of the building while mould, often formed by moisture damage, can lead to health problems for the residents.

According to Research & Progress (2009), building materials must be protected against rain during transport as well as construction phase. This requires resources in the form of large tents and tarpaulins are required to keep the construction site dry. This therefore entails additional costs for the construction projects, but at the same time generates benefits through better work environments for the construction workers. According to Giang & Moroz (2013), these tents bring an environment in which humidity can be controlled to reduce the risk of moisture damage and mould. The construction phase therefore usually begins by constructing a tent to commence construction.

4.5 Advantages associated with public-private partnership

There are several different driving forces that drives the actors to enter a public-private partnership. One of these driving forces is that cooperation between the public and private actors often leads to innovative solutions. Through long contract, up to 40 years and spanning the entire project life cycle, there are opportunities to develop new approaches (Andersson & Siren, 2009). SALAR (2007) are in the same direction as public actors can request a long-term business relationship with a knowledgeable private actor. Through these long contract times, therefore, security is created for the involved actors where a successful partnership can be developed.

As the private operator is profit driven, the cost-effectiveness of the project is pursued, which leads to a desire to develop, improve and create new solutions regarding possible problems (SALAR, 2009). Dutta (2012) believes that public-private partnership generates a wider dissemination of knowledge and information, which contributes to a broader working culture where innovative solutions and creativity emerge. This is achieved through longer contractual and large-scale projects that are usually beyond the traditional capacity of the private operator.

Bondesson & Erlingson (2012) presents several important aspects with PPP as a form of collaboration. In order for a company to be competitive in a market, especially in the construction sector, it is necessary that the company strives to be specialists in its field of activity. When the company is often responsible for certain specific areas of a production chain, an expertise arises. This knowledge and information generates efficiency, which gives one of the reasons why public-private partnerships often occur. Through cooperation, each actor can focus on the areas they are best placed to manage while disseminating information and knowledge among stakeholders. According to a report by SALAR (2009), labour and knowledge are the most important factors for municipalities and county councils to establish cooperation with local builders in order to gain expertise in certain areas.

4.6 Disadvantages associated with public-private partnership

Public-Private partnership has been heavily questioned since this collaboration form broke through, not only in Sweden but also in other countries. According to Bovaird (2004), political control over decision-making has meant that trade unions have been strongly critical of this form of cooperation as they fear that employment conditions are deteriorating while a reduction in jobs can occur. The criticism of public and service users has instead been

directed towards involving the profit-driven private actors in this cooperation. According to Andersson (2008), a mutual understanding between the various parties must be in order to create a well-functioning cooperation. The maximizing profits of the private operator leads to efficiency which can benefit the public actor, hence acceptance and understanding must exist for this form of cooperation.

What characterizes this form of cooperation is that the financial risk that accompanies the project is often transferred to the private actor (Edmark, 2016). Hence, great demands are made on the need to establish a risk analysis to find out what risks the project entails. A central part of this cooperation is that the risk are disturbed to the actor who are best suited to dealing with them (Andersson & Sirén, 2009). The public actor indicates the risks posed by the project, and then the private actor put their bid with the risk in their knowledge.

Consequences that may arise from an absence of risk allocation is that the project is delayed by increasing capital costs as a result. If this occurs, renegotiation between the parties may result in protracted and costly processes (Hallström *et al.* 2014). According to an article from SALAR (2009), could unclear definitions of processes can become factors for protracted discussions. These uncertainties can thus lead to delays in the project and budgetary overrides which in turn may have an impact on the core business of the facility, such as hospitals or schools.

According to Hallström *et al.* (2014) there is growing criticism and scepticism about the effectiveness of a PPP. According to the critics, it is difficult to compare projects carried out by PPP with other projects, which makes it difficult to draw any conclusions on the effectiveness of cooperation. The stakeholders who are promoting PPP believe that cooperation implies efficiency, financial control and innovative solutions. Opponents, however, argue that this synergy often leads to increased capital costs, surplus private profits and complex agreements.

In order for these partnerships to be successful, the result of the project is often strongly associated with expectations, overall impression, commitment from the parties and clear guidelines and agreements. A public-private partnership should therefore be seen as a living process that evolves over a long period of time (Rotter & Özbek, 2010).

5 Results

This chapter presents the results obtained from the qualitative interviews in the study. The respondents' answers are presented where the structure of this chapter follows the interview guide used in all interview cases.

5.1 Wood as a construction material

In this first part of the interview, respondents were asked to answer questions about the advantages and disadvantages of wood as a building material. Two of the respondents pointed out that the municipality does not take a position on which material is better than others. The two respondents clarifies that politics should be neutral to technology, that is, not to favour different types of technical solutions. However, the municipality can make demands on the function linked to different projects. It is then up to the builders to live up to the requirements that the municipality formulates, which in turn leads to entrepreneurs having to plan according to the municipality's requirements and then choose which building materials or construction techniques to use.

There are both advantages and disadvantages of this material and respondents answers are presented in this chapter. The majority of respondents agreed that wood is a more climate-friendly and renewable material that should be used more in the construction sector.

Some of the respondents described that the building materials available on the market have different advantages and disadvantages depending on the project or building to be built. It also depends on what the entrepreneurs have on the project.

A summary of respondents' answers on question 1 and 2 and from the interview guide is presented below, in chapter 5.1.1, 5.1.2 and 5.1.3.

5.1.1 Respondents perceived advantages of wood as building material

Respondents were asked to answer the question about which advantages they experienced with wood as a building material. Respondents' answers are presented in Table 5. Respondents' answers are presented in continuous text, which means that different municipalities have highlighted different advantages of wood as building material. However, the considered is made that the interesting about this subject is what benefits are experienced with wood, not who highlights them.

Table 5. Respondent´s perceived advantages of wood as building material

Climate-friendly and renewable material	A majority of the respondents answered that wood is a climate-friendly and renewable product that binds carbon dioxide during its growth, which gives positive effects from a greenhouse gas perspective. Another difference between the different building materials is that some materials can be recycled. For example, wood can be used for heating after the building has been demolished.
Construction project time	The time required for establishing a wooden house from, for example, Martinsons or Lindbäcks is much shorter compared to if the same house or construction would be built in concrete or steel. The time schedule is described to be halved depending on projects and materials. This not only causes the house to be established faster, but also quicker access to rental income.
Better work environments	The work environment is described as considerably improved in in the case of wooden house construction compared to construction with concrete and steel. This is described as an advantage where construction workers can work in more controlled and improved work environments.
Light material	Light structures enable the construction of existing houses without the need for reinforcements in the basic work. At the same time lighter materials lead to cheaper transport, which is seen as a major advantage.
Large supply of raw materials in Sweden	Sweden has large supply of forest, which gives a large supply of locally produced raw material. There are therefore great opportunities to expand wood construction in Sweden. However, there will always be combinations of building materials such as concrete, steel and wood.
Fireproof materials	Wooden beams burn on the outside but maintain their stability and strength in the event of fire. A steel or iron beam is more unpredictable in fire and must be replaced after it has burned in the structure. A wooden beam, on the other hand, maintains its properties even during and after a fire, because wood is an insulating material and therefore the beams do not always need to be replaced after the fire. Of course, it depends on the extent of the fire and how damaged the wooden beam will be after the fire.
More flexible solutions	Wood as building materials enables more flexible solutions in the construction phase. Wood also allows for buildings on existing buildings, which cannot be done to the same extent with other materials such as concrete.
Increased competition on the market	There is an ongoing development in the market where different materials tend to stimulate each other. The increasing wood construction has meant that the concrete industry raises its ambitions and develops, for example, carbon neutrality and functionality to maintain market shares. One of the respondents highlighted the benefits of increasing competition; "Different materials and techniques tend to drive each other into development. This competition has made them today have similar performance levels, which is a result of market demand and competition. Had these materials not been so close to each other in performance levels as they do today, no choice had to be made ".
Possibility of prefabrication	Prefabrication can produce building elements in a controlled environment while making production more efficient. Work environment also described is improved by prefabrication. Because the material is lighter than other competing materials, prefabrication can be carried out and then transported to the location to which the building is to be constructed. This is described as a significant advantage.

The main advantages of wood as a building material are described as the possibility of prefabrication, climate-friendly material and increased competition in the construction market.

5.1.2 Respondent´s perceived disadvantages of wood as building material

Respondents were asked to answer the question about which disadvantages they experienced with wood as a building material. Respondents ' answers are presented in Table 6. Respondents' answers are presented in continuous text, which means that different municipalities have highlighted different advantages of wood as building material. However, the considered is made that the interesting about this subject is what benefits are experienced with wood, not who highlights them.

Table 6. Respondent´s perceived disadvantages of wood as building material

Increased cost and less fire safety (Myths)	Two of the respondents describe that there are old myths about wood as building materials on the market. This is described as part of the lack of knowledge in the field. Examples of these myths are that wood is more flammable and costs increase. This myth is derived from Sweden's fire history and that this concern is described remains in existence today. Respondents describe that there is the same requirement for fire safety in wooden houses as in, for example, concrete houses. At the same time there are building methods that make wooden buildings do not necessarily increase production costs.
Requires new technology	Wood as building material requires other techniques and knowledge when counting on strength and stability in a wooden building. This may be a disadvantage at first, however, the industry is described to learn this technique quickly if the builders choose to step into these new working methods.
Few producers of wooden building elements	The majority of respondents describe that the producers of building materials in wood have not been able to meet the demands of the market. This means that the developer must use other competing materials in the projects. Wood as a building material has recently been very much in demand and the industry is not seen to be able to meet this growing demand. One of the respondents describes that the municipality in a project planned to use wooden frames. It was found that the manufacturer and supplier of wooden frames could not deliver the building material on time. As a result, the builder was forced to use concrete structures instead of the intended material wooden frames.
Increased cost	About ten years ago, the construction projects, which are built with wood as building materials, were often more expensive. Today, however, there is no significant difference in price between the projects built with wood as building material compared to concrete. Production can initially be slightly more expensive with wood construction, if you on the other hand look at a lifecycle perspective, wood is not perceived as a more expensive material today.
Sound transmission between the building´s floors	In the past there have been difficulties in reducing the sound transmission between the building's different floors and apartments in wooden houses. However, new technologies in the market are being developed as described have significantly reduced this disadvantage

The results from the interviews show that there is very few perceived disadvantages of wood as building material. A majority of respondents agreed that historical myths and prejudices, such as cost and fire safety, remain on the market today. However, this can be attributed to a lack of knowledge in the market surrounding this new building material.

5.1.3 Experienced challenges with wood as building material at major municipal construction projects

Conservative industry
A majority of respondents describe that there is a habit of building with steel and concrete in the market. Steel and concrete have been leading the market for a long time, which means that the industry has been adapted to these types of projects and methods. Therefore, there is some inertia in the market which has created an ignorance of the wood as a building material but also around the new methods linked to wood construction. The construction industry is conservative where major construction companies have established building systems and usually choose proven methods and materials such as concrete. Also suppliers of building elements are included in this type of conversion when the material wood requires a different production line. Readjusting to other materials therefore requires a lot of knowledge and other contacts. Therefore, initially it becomes very expensive.

One of the respondents describes that, when the construction industry is conservative and that the cost issue is crucial to the projects, wood as a building material may be more difficult to compete against other materials and proven technology. Here, the sustainability and climate aspects of wood as building materials must be highlighted, throughout the entire chain in the construction sector.

By departing from the well-proven material concrete, cost control is reduces. This is described as a certain lack of knowledge about the building material wood and the methods that this material entails. Two of the respondents describe that this lack of knowledge has recently diminished and that more players feel more confident in using wood as building materials.

Combine materials while creating Sustainability
The ability to combine concrete and wood is described as a good future alternative for larger construction projects. Concrete is needed, according to one of the respondents, to provide increased stability and strength in the building. Sweden's cities are building ever higher houses and therefore the combined materials are described as a good option to be able to develop the cities and at the same time create increased sustainability.

Ignorance and lack of experience
There is an inhabitant to use wood as a building material, which means that there is a lack of knowledge in the field. The lack of knowledge and ignorance can be found in both the administrator, the planner, the design and the private and public construction companies.

A majority of respondents describe the need for research and development in the market. At the same time, colleges and universities need to develop new methods regarding wood construction and how to protect the building material at the construction site to secure modular construction. Therefore, new experience and increased market knowledge are needed in the form of more new entrants to develop the market more quickly.

Few producers of wooden building elements
Some of the respondents describes that there have historically been too few suppliers of wooden building material which has caused some difficulty in moving to wood as a building material. Today, the industry is developing to meet market demand, but more suppliers are still needed to meet demand.

5.2 Cooperation between public and private actors in major municipal construction projects

To get a picture of how the different municipalities cooperate with private actors in major construction projects and how the work distribution looks like, an open question was asked to respondents (question 3 from Appendix 1, Interview guide)

A majority of respondents describe that co-operation takes place within the municipality in different constellations. A couple of respondents state that municipal companies are largely used for major construction projects within the municipality. It turns out, however, that these municipal companies may, in turn, hire private actors.

The results show that cooperation between public and private actors is taking place in a large part of the municipalities today. At the same time, respondents argued that cooperation is very important within the municipality in order to be able to carry out these larger and more complex construction projects. The private actor is responsible for the implementation of the construction project and at the same time financing. The public actor is usually responsible for the planning stage of the project. Co-operation usually occurs through a land allocation competition where tenders from private operators are submitted and then a private builder is selected for the project. Respondents' responses are presented as a whole in Appendix 2.

Subsequently, the respondents answer questions involving perceived advantages and disadvantages of collaborative form PPP. Here too, the assessment is made that the interesting thing about this is what benefits are experienced by PPP, not who highlights them. Therefore, the answers are presented in current text, which means that different respondents may have highlighted various advantages and disadvantages of the PPP partnership, but do not specify this in the text.

5.2.1 Perceived benefits of public-private partnership

Opportunity to influence the market

A couple of respondents describe that the municipality is very focused towards quality and sustainability which made the industry realized that the quality of the projects is the competitiveness of these collaborations. Private construction companies create competitiveness and competitive advantages by being oriented to the quality of construction projects. Through land allocation, the municipality can aspire to high quality of the projects and at the same time, through its demand, affecting the product of the project.

Increased information and knowledge dissemination

A majority of respondents highlight that cooperation increases knowledge and information dissemination, which is considered as positive. Through increased cooperation with the market and industry the municipality can learn from how effective processes can be carried out. Through this interaction, the municipality gets a completely different resource and learns a lot from the business community. At the same time, there is a good dialogue and discussion between market actors which are developing information and knowledge dissemination.

Conversations and discussions between different people with different perspectives, tends to create more knowledge dissemination. This is described to bring about greater understanding between the various actors on the market.

Spreading risk
Risks associated with the project can be spread between the involved actors. This creates a risk spread associated with different steps in the process, but at the same time an economic risk spread.

Increased efficiency
The majority of respondents describe that the collaborative process produces an increased dissemination of information and knowledge, which is considered to make the project more efficient.

Increased competition in the market
Through cooperation constellations, competition is taking place on the market, which some respondents consider to be positive. Builders tend to push each other to become better which provide increased efficiency, increased knowledge on the market and increased innovation development.

5.2.2 Perceived disadvantages / difficulties associated with public-private partnership

A majority of respondents do not experience any significant difficulties or disadvantages linked to the form of cooperation, but emphasize many positive effects that collaborative forms entail. Two of the respondents felt that this question should be addressed to the builders or the municipalities that are more involved in the cooperation and described better suited to answer this question.

Lack of skilled labour
Because of the market's current economic boom, it can be difficult to find skilled labour. At the same time, two respondents argued that education needs to be reviewed in order to develop increased knowledge of both different construction processes and different building materials.

One of the respondents points out that there is a competence supply problem in the planning phase. It is described there is a shortage of good architects and house architects in the market while building projects have increased significantly in the market. This lack of good architects is described as a bottleneck in the Swedish construction industry, regardless of the organizational model. Therefore, more skilled planners and house architects are required in the market.

Collaboration requires trust
In collaborative forms, trust is very important. In these collaborations it is therefore important that agreements are being followed to establish a good relationship between the various actors. In these agreements it is important to specify which agreements have been made and what happens if these are not followed.

One of the respondents describes a difficulty finding individuals and construction project managers who can design collaborative projects. These individuals should have experience of previous collaborations in the construction industry and how these agreements should be structured to create good trust between the actors.

Different interests to be met
One of the respondents describes that there are major challenges in the cooperation, which refers to different actors having different interests. This is the purpose of the process and the

political task, making balances to try to meet the various interests that exist.

The respondent describes that there are essentially three different interests involved in the construction project:

- Builders interest. The private actors are described as profitable and therefore it is important that their interests are met in the collaborative form.
- The municipality that monitors the overall public interest
- Other interests linked to the construction project. Examples of other interests may be those who live near the project.

This consideration process that addresses different interests is described as one of the reasons why planning a construction project may take a long time. The system and the planning process described in itself works well, though, the system is described to be designed in such a way that in some cases it may be unnecessarily complicated. An example of this is that there are many instances for different appeals, which can contribute to an inertia in the processes and thus cost money.

5.2.3 Respondents ' views on the overall factors that govern the choice of building materials within the municipality today

Solna Municipality – Svenonius. T
The municipality acts technologically neutrally and therefore should not describe or regulate which material or technology is to be used for different projects. The respondent therefore does not want to speculate about which materials will be used more or less in the future.

There will generally be higher demands on climate neutrality and reduced climate emissions in construction projects in Sweden. Then it is up to companies, regardless of the materials used, to be able to meet the demands of municipalities and the market.

Uppsala Municipality – Hollinder. A
What governs the choice of materials is described as a combination of what the public actor requests in the construction projects and land display competitions as well as what the contractor is submitted for tenders or competition proposals. There are also municipal companies that build, which also partly govern the market. The respondent therefore describes that the municipality plays a major role in the choice of building materials linked to certain projects.

The knowledge among the builders and stakeholders must exist to target the market towards increased wood construction. When larger players expand their industries and make proposals for wood construction, the market shows that the larger actors sees potential in increased wood construction, and that these develop methods to meet a certain market demand. This raises interest among other suppliers and entrepreneurs.

If there is an increasing interest in wood building on the market, for example, by increasing demand from public actors or stakeholders, the entrepreneurs see this as a business opportunity. The choice of building materials is therefore partly governed by what is demanded from municipalities and stakeholders, but also how the market itself evolves.

Sustainability is a major issue on the market today. The respondent describes that active work is being done within the municipality to reduce climate impact from transport and construction projects.

Västerås Municipality – Kallsäby. L
In the projects carried out by the municipality in wood material, the municipality has set environmental and climate requirements. Through these requirements, wood material has had a clear advantage over other competing materials. Other wood construction projects carried out in the municipality have been based on the tenders submitted to the municipality. It is usually the private actor/builder that chooses materials, however, the municipality verifies that the project is feasible and that the plan is consistent with the design program that the municipality has developed for the area.

Wood as building material is perceived as more expensive, which may affect the choice of building materials for larger projects.

Örebro Municipality - Toro Hartman. C
There is a great focus on sustainability in the market today and construction projects should be as environmentally friendly as possible, however, this does not mean that everything should be built in wood. This decision, the municipality cannot unequivocally control over. On the other hand, the municipality asks for environmentally friendly construction as possible, which is conveyed in the land display competition, in order to show entrepreneurs that the municipality focuses on sustainable construction. When increased durability is demanded in the land display competition, wood as a building material is described as having a competitive advantage.

Wood was a few years ago an expensive material, but the price does not differ so much between different building materials today. However, the cost picture is described as a factor in the selection of building materials.

Malmö Municipality – Nellerup. J
J. Nellerup from Malmö municipality describes that politics controls the choice of building materials today. Politics puts the building frameworks where examples of these frames can be how much the project may cost or how large the building should be. The politics also sets the focus on the sustainability level at which the new projects will be built.

What cost level and sustainability level demanded in the projects is regulated in the control document.

Umeå Municipality – Berg. U
The municipality does not want to be decisive about the choice of building materials. The municipality communicates that legislation is to be followed and at the same time as the municipality does not want to impose too many requirements to thus be ruling.

”The network "started 10 years ago and was on a voluntary basis. The market thus began to change its attitude towards construction and various building materials. Through this network, actors and producers of building materials could meet and discuss while the spread of knowledge increased on the field. The approach to methods and technology in the market has thus changed on a voluntary basis through meetings and discussions between market actors.

That the municipality should be decisive and steered around the building materials had not worked in Umeå when the municipality feels that the society and the actors on the market had appealed such a decision. This appeal would have resulted in the decision not being statutory.

The respondent believes that the municipality can only make demands on building materials on municipal land when the land is allocated. The respondent also states that there is an inertia on the market, which means that it takes time to make changes. There is a fear of moving away from traditional and proven methods. With previously proven methods and working methods, the player knows "how to calculate the project" which is described as one of the reasons why this inertia exists on the market.

Linköping Municipality – Wiklander. J
Today the choice of building materials is often habitually. The respondent describes that analyses about which material are best suited for a particular project are often lacking and the construction sector wants to use proven materials and methods, usually concrete and steel.

The industry is used to building concrete, and therefore concrete is usually used for major construction projects. Exception is when the municipality requires another type of material for a particular building project. The construction industry is conservative, as a result, concrete is usually chosen because the operators feel more secure with this proven material. However, the respondent describes that the construction industry is changing and that new materials and methods have begun to emerge. Here, the municipality can also have an impact by requiring different techniques and materials to be used at the land display competitions.

The respondent wants the larger construction companies to move more freely between different materials. Today, the construction companies preferably use proven methods with concrete as material choices.

5.3 Future prospect

5.3.1 What the respondents perceive as limiting to wood as a building material

Myths
According to a couple of the respondents there is a belief in the market that wood construction becomes more expensive compared to concrete projects. At the same time, some of the respondents describe that there is a belief that wood is more flammable, which is based on Sweden's fire history.

Costs
A couple of the respondents describes that there is a perception on the market that projects carried out with wood as building materials have higher production costs compared to, for example, concrete. This view refers to the idea that wood as a building material has previously been an expensive material, however the cost image between different building materials does not differ significantly today. However, it should be added that cost and knowledge are correlated, which means that wood buildings can initially be more expensive. However, increased knowledge and technology development entails that costs are reduced.

Ignorance and lack of experience
A majority of respondents believe that ignorance and lack of experience in the construction sector have contributed to a limiting factor in the construction of wood. There is an inhabitant to use wood as a building material, which entails that there is a lack of knowledge in the field.

Therefore, research is needed on this area, while increasing knowledge and information dissemination can reduce this limiting factor. At the same time, new experiences and increased market knowledge are needed in the form of more new actors to develop the market more quickly. Therefore, there is a great responsibility for the educations offered in Sweden.

Technology
Wood construction requires another technique and knowledge. This may be a limiting factor initially, however, the industry is described to learn this technique quickly and this technology is gradually evolving in the market.

Established working methods on the market
Incorporated working methods and construction systems are described limiting wood construction. There is an inertia in the market, which means that it takes time to make changes. At the same time, there is a fear of moving away from traditional and proven methods. With proven methods and working methods, the private actor knows how to calculate the project, which is described as one of the reasons for this inertia being on the market. Therefore, more niche actors are described as being needed on the market, the more market participants the faster the market can change.

Politics
One of the respondents describes that politicians have a major role to play in moving to more wood construction on the market. Knowledge of the negative environmental effects of the various building materials must be communicated to the political level. To get a change, the industry needs to try to change the different approaches that exist around different building materials. Municipalities and politicians cannot control or force the construction industry to use, for example, wood as a building material to try to change the market's approach to wood construction. This initiative must come from the industry in order to send signals to politicians.

5.3.2 How respondents believe that wood construction will develop in the future

Solna Municipality – Svenonius. T
The municipality wants to act technologically neutrally. Therefore, do not want to speculate about which materials will be used more or less in the future.

Uppsala Municipality – Hollinder. A
Knowledge of the climate impact of the building process (and if you aim to reduce this effect) Allows both the municipality and the industry to draw certain conclusions : ”It would be good, if you want to achieve a lower climate impact, and if you think you can build in wood, you should probably do it too”

This is a question that the municipality can raise in the land display competition in order to influence the choice of materials and working methods for certain projects. The industry can also make a bid for so-called ' green tenders '. In addition to the requests and requirements of the municipality, the private operator can therefore promote its own proposals that are more climate friendly.

What controls the choice of materials is therefore a combination of what the municipality requests in its construction projects and land display competitions as well as what the private actor enters for tender.

Västerås Municipality – Kallsäby. L
Wood construction will increase. There will also be a climate adaptation around the production of different building materials. If we look at the entire production chain from plant to finished building materials, wood as a building material should increase as it is a more climate-friendly and sustainable material.

- Big threats to wood construction is if there is an increasing conservation status in forestry. Today, the production targets and the environmental goals are equated. Should the production targets be reduced or removed and more focus will be placed on the climate targets, it will be a major problem with the raw material supply.
- The price of different building materials is an important factor.
- Wood as a building material does not work everywhere. Therefore, combinations of different building materials and also variations between different building materials may be required depending on the project and application area.

Örebro Municipality - Toro Hartman. C
The municipality does not find that modular buildings in wood are more expensive compared to other projects and building materials which the municipality describes as positive. The municipality is working on expanding some existing areas within the municipality and in some of these projects wood is used as building material.

Örebro municipality works actively with sustainable construction within the municipality.

Malmö Municipality – Nellerup. J
- The trend in Sweden today is that wood construction is increasing.
- There is a political pressure to become more climate-neutral.
- Population development means that the market needs more flexible buildings that can easily be rebuilt, changed and refined over time. Which benefits this type of construction.
- In the current situation, the demand for housing and buildings is large, while the concrete elements are starting to run out in Europe. Therefore, you have to look at other markets and materials.

Umeå Municipality – Berg. U
With the established network and collaboration designed in the municipality of Umeå, much is said that wood as building materials will be expanded within the municipality. Wooden houses are superior when looking at sustainability and climate perspective. Wooden houses are a carbon sink in nature and it is a material that breathes and thus controls the moisture in the buildings. There has also been a study that people feel better in wooden houses than in concrete buildings.

The respondent believes that wood as building materials will increase in the future and emphasize that municipalities and politicians have a major and important role in the expansion of wood construction in Sweden.

Linköping Municipality – Wiklander. J
The respondent hopes and wants wood as a building material to become more abundant and develop in the future. There are few problems and disadvantages of wood as a building material and very many advantages. "Wood is the future".

5.3.3 Respondents' future planning / strategy related to wood construction

Solna Municipality – Svenonius. T

- The municipality is technically neutral. The respondent believes that politicians should not have a determining role and favour different building materials or technologies.
- Functional requirements are considered as a better method of working compared with municipalities and politicians actively deciding on the choice of building materials.
- In the future, the municipality of Solna will continue to work on complying with the national rules that exist, regardless of which area this includes.
- Builders often have higher ambitions than required, which is perceived as gratifying within the municipality.
- The municipality makes balances about which "on-site construction sites with exact location adaptation" to be done, which are often expensive, as well as which modular buildings to be made. This is a balance where both methods must be used depending on the type of project to be built. This balance is described as part of the municipality's daily planning process.

Uppsala Municipality – Hollinder. A

- In Uppsala's climate protocol Working municipality with different materials in construction. The climate protocol focuses on sustainable construction and thus also focuses on wood as a building material.
- In 2018, the municipality has developed a wood construction programme. The municipality wants to increase the timber construction and has developed clear objectives regarding the municipality's sustainable construction.

According to the respondent, the municipality will continue the work on the land display model to obtain proposals and tenders of wood construction and through the land display model find private actors who can carry out these projects. "The municipality sees a long-term construction of wood as a way of achieving a more climate-neutral and climate-positive municipality."

Västerås Municipality – Kallsäby. L

There is no policy on wood construction within the municipality today.
In the municipality's environmental and climate programs, the municipality should look at, among other things, life cycle analyses of the various building materials used.

Örebro Municipality - Toro Hartman. C

Works on developing an action plan for the city's construction, which is being revised. This action plan is being called "strategy, architecture and construction in the municipality of Örebro". The action plan says what the municipality asks for construction focused on architecture, building materials, etcetera. Environmentally friendly materials are requested in this action plan, and wood construction is also being discussed.

The municipality will continue to demand sustainable construction in the future where wood as a building material is described as a good alternative. Örebro Municipality works actively with sustainable construction within the municipality and has wood construction projects started in the municipality at present.

Malmö Municipality – Nellerup. J

Malmö municipality has begun discussing the issue of wood construction within the municipality. Discusses how the municipality's strategy will look more closely regarding

wood construction. There is no wood construction strategy in the municipality at this time.

Umeå Municipality – Berg. U
With the established network and collaboration designed in the municipality of Umeå, much is said that wood as building materials will be expanded within the municipality. The municipality will, along with the other actors in the network, continue to develop the project started with 3,000 units with focus on sustainable construction.

The municipality and politicians are described as having a major role in the expansion of wood construction. What the municipality sends for signals to the industry is described as important.

Linköping Municipality – Wiklander. J
- ”Vallastads project”.
- In the land display competition for the project, the builders received extra points if they intend to construct the project using wood as building material. Through this system, the municipality can ask for more wood in construction. In the Vallarstad project there are several different projects, both townhouses and multi-family houses that are built with wood as building materials. The municipality will continue to expand the area and will continue to premier wooden houses.
- The municipality has more land display competitions at the moment where they want to advocate wood as a building material which is discussed daily with different plan managers and directors.

”Municipalities should use wood to a greater extent in residential buildings and use concrete where is needed, for example, infrastructure” (Wiklander. J).

6 Analysis

This chapter analyses the results obtained through the qualitative interviews with the theory presented in chapter 2.

6.1 Cooperation to address complex challenges

According to Dutta, (2012), the private as well as the public operator can benefit from entering into partnerships. In collaborative forms, resources and risks can be spread between the actors, while more complex issues can be addressed. However, through this form of cooperation, actors' strengths are blended as the interests and goals. At the same time, it is possible to improve Sweden's cities from a sustainability perspective, and through the collaboration generate increased efficiency and innovation development.

Results from the interviews show that collaborations linked to major construction projects exist within the municipalities today. Some of the municipalities use municipal construction companies, which in turn could hire private companies to carry out municipal construction projects. A couple of respondents argue that the municipality has an enhanced opportunity to influence the market through synergy constellations. The public sector can thus demand increased quality and sustainability linked to the construction projects. This is considered very positive as the municipality, through the cooperation, can develop the sustainability of the project. According to the study results, the risks associated with larger municipal construction projects can be spread between the involved actors. This is through financial risk spreading and risk diversification linked to different stages of the process. The result can therefore be linked to Dutta (2012), which means that resources and risks are spread to the actors who are best placed to handle these.

Bovaird (2004) describes that the collaboration generates new methods, techniques and approaches, which are described as a result of increased information and knowledge diffusion on the market. The results of the study can be linked to Bovaird (2004) when a majority of respondents believe that collaborations generate increased information and knowledge dissemination, which is considered positive. Through expanded information and knowledge dissemination, the industry's actors can learn from each other while increasing understanding develops in the market. Through this increased knowledge dissemination, new methods can be developed while competition in the market tends to drive companies forward.

According to LaFrance & Lehmann (2005), a partnership coordinates different strengths and benefits in the form of different actors. The public operator is described as contributing with networking and experience to the cooperation while the private operator possesses a technical expertise and large financial resources. Through a partnership, different strengths can therefore be coordinated, providing the opportunity to respond to complex issues while at the same time giving operators a competitive advantage.

The majority of respondents believe that skilled labour is demanded in the construction industry and in collaboration solutions. According to LaFrance & Lehmann (2005) the private operator is described as profit driven, which entails a cost awareness of the project and therefore efficiency. Through these forms of cooperation, the private operator contributes with skilled labour and financial strength. Some of the respondents describes that, through the municipality's land allocation agreement, knowledgeable private actors can be located and used in major municipal construction projects. Therefore, public and private strengths can be

mixed to carry out larger and more complex projects. The results of the study can therefore strongly be linked to theory presented by LaFrance & Lehmann (2005) in this study.

6.2 Collaboration process and driving factors wanting to enter into partnerships

In order to create successful cooperation, it is described that trust between the actors involved is very important and fundamental. At the same time, the partnership will generate competitive advantages that the individual operator cannot create on its own. Another important part of the cooperation is described as clear objectives, rules and agreements, thereby structuring the responsibilities of the actors and avoiding unnecessary misunderstandings (Glasbergen, 2011).

The results of the study show that good trust between the actors in the collaboration is important. The respondents describe that it is important that agreements are being followed to create a good relationship between the different actors. In these agreements, it is important to specify the agreements made and to structure the responsibilities and objectives of the cooperation. One of the respondents describes that there are difficulties in finding people and building project managers who can design these collaborative solutions. In order to be able to formulate the agreements required in the cooperation, previous experiences on this form of collaboration are required.

LaFrance & Lehmann (2005) describes that partnerships are based on good relations where the individual actor's goals are to be achieved. Through the achievement of expectations and objectives, successful cooperation can benefit more different actors. According to the results of the study, cooperation should meet a wider range of interests, which is described as a major challenge. The municipality monitors the public interests while the private operator is described as profit-driven. In addition, other interests are linked to various construction projects that need to be considered. Therefore, two respondents describe that a major challenge linked to the cooperation is to respond to the different interests associated with the cooperation.

Glasbergen (2011) Describes that collaboration forms are organizing the right actors to the right challenges to be solved. In this way, partnerships can develop a new environment in which sustainability aspects can be discussed. Through these discussions and solutions, social management can change in a structured way. It should be added, however, that the success of the partnerships often depends heavily on public actors and government policies.

The results of the study show that the respondents feel that the collaboration can locate and coordinate the right actors for the right tasks. Through this synergy the knowledge between the actors increases, while larger and more complex issues can be addressed. The majority of respondents describe the development of sustainability work within municipalities through initiatives from the market and increased understanding and knowledge diffusion. This knowledge dissemination takes place through discussions between both public and private actors. The results of the study can therefore be strongly linked to the theory presented by Glasbergen (2011).

6.3 Public-private partnership focused on the construction sector

According to Hallström et al. (2014), the private operator is usually responsible for the implementation, financing, maintenance and operation of the project. The public operator is usually responsible for planning, permits and ownership of the project.

A majority of the respondents describe that there is cooperation between private and public actors in major construction projects within the municipality. The respondents describe that the municipality is responsible for planning and building permit issues. The private actor is responsible for construction, financing and the project plan. The results of the interviews show that division of responsibility is highly comparable with the theory presented by Hallström et al. (2014) and figure 3 from KPMG (*2007, p.4*).

According to the E-G Commission (2004), the feature of Institutional PPP is that ownership is shared between the private and public actors, which means that both actors are jointly responsible for the various stages of the project. Contractual PPPs, on the other hand, are based solely on relationships through agreements and contracts between the private and public actors. This is described as the usual type of PPP and is used for projects of a simpler nature where no difficulties arise in contract writing (E-G Commission, 2004).

The results of the study show that both municipal construction companies and private property developers are used in a majority of the municipalities. The results of the interviews describe the majority of PPP being made through contractual PPP. Collaboration takes place through land allocation and land display competition where private actors can show their interest based on the municipality's requirements. Two respondents state that institutional PPP has been established within the municipality, which is derived from larger and more complex construction projects. In these projects, ownership of the construction project has been shared between public and private actors. Theory presented by E-G Commission (2004) combined with Figure 4 and 5 can therefore strongly be linked to the results of this study.

The result of the qualitative interviews shows that both the contractual and institutional PPPs are used, but the result is that, in particular, contractual PPPs are used for construction projects within the municipalities.

6.4 Procurement forms within public-private partnership

According to European Parliament and council directive, (2004/18/EG) there are five different types of procurement. What separates these types of procurement can be described as how the public actor chooses to invite private actors to the project and which actors are given the opportunity to show their interest in the project. These procurement forms are divided into open procurement, selective procurement, negotiated procurement, competitive dialogue and project competition. In areas such as urban construction, rural planning and architecture, procurement is usually used through project competition or open procedure (European Parliament and council directive, 2004/18/EG).

The results from the study show that a majority of respondents use marking contests for municipal construction projects. Responses from respondents describe that the procurement within the municipality takes place primarily through a project competition, but also through

open procedures. This can be linked to the theory presented by European Parliament and council directive (2004/18/EG).

6.5 Drivers to enter into partnerships in the construction sector

Hallström et al. (2014) describes that there is an increased need for efficiency, knowledge and improved resource utilization, all of which are described as driving forces to enter into partnerships. Partnership brings together different interests and hence there are different driving forces that attract different actors into collaborations.

The results of the study show that the respondents are demanding skilled workers who can perform major municipal construction projects. The private actor is described as profit-driven while the public operator works for the public interest. A majority of respondents describe that the collaboration process produces increased information and knowledge dissemination, which is perceived to make the project more efficient. At the same time, cooperation leads to increased competition in the market, which tends to push companies better. This increasing competition is described as generating increased efficiency, increased market knowledge and increased innovation development.

According to the SALAR (2007), different driving forces between the public and private operators differ. However, the cooperation between these actors is described as creating common and individual competitive advantages. The public operator is described as asking for increased efficiency, higher innovation development, increased risk diversification and local skilled workers. The private operator can, through cooperation, demonstrate greater accountability while the cooperation can lead to increased sales and access to new markets.

Respondents highlight increased information and knowledge dissemination as a driving factor in concluding partnerships. At the same time, private actor can create competitive advantages by, for example, being more focused on sustainability and quality. Municipalities are partly described as being able to control the construction project at the project competitions, therefore the municipalities are perceived to be able to influence the market to a limited extent. However, it describes the importance of initiatives and innovation development coming from the market and private actors. This innovation development allows private operators to drive each other and develop the market at the same time. The theory presented by SALAR (2007) can be closely linked to the study's results regarding different actors having different driving forces to enter into partnerships.

Another important aspect is that collaborative forms enable more comprehensive and complex issues to be met while creating competitive advantages for the individual actor. Thus, through PPP, the climate issue can be dealt with effectively, while the individual actor is responsible for the market (LaFrance & Lehmann, 2005).

To address issues such as climate issues and sustainable urban development, some of the respondents describe the need for cooperation. These issues cannot be solved by the individual actor on their own, but the interaction described is needed on the market.

6.6 The market's perceived advantages and difficulties with public-private partnership

6.6.1 Perceived benefits of public-private partnership

According to Andersson & Siren (2009), cooperation creates a higher innovation development through longer contract periods. PPP can result in contract periods of up to 40 years that span the entire project lifecycle. This is described as creating a higher rate of innovation in the context of the development of the market approach. At the same time, the SALAR (2007) describe that public actors demand long business relationships with talented entrepreneurs. This will create both security for the actors involved, while increasing the pace of innovation on the market.

Most of the respondents describe trust as very important in the collaboration. In these collaborations it is therefore important that agreements are being followed to create a good relationship between the different actors. In these agreements it is important to specify which agreements that's been made and what happens if they are not followed. A majority of respondents also present that an increased rate of innovation and efficiency can come about through collaboration discussions and knowledge dissemination. The results of the study can be partly linked to the presented theory by Andersson & Siren (2009).

According to Bondesson & Erlingson (2012), a knowledge and expertise arises among private actors. This is explained by companies operating in a competitive market where expertise and specialized knowledge are requested. This knowledge and information usually generates an effectiveness which gives one of the reasons why public-private partnerships often occur. Through cooperation, each actor can focus on the areas they are best placed to manage while disseminating information and knowledge among stakeholders. At the same time, PPP is described as increasing the dissemination of knowledge and information, which is described as contributing to a broader working culture where creativity is emerging (Dutta, 2012).

The respondents in the study highlight most of the benefits of PPP as a form of collaboration. One of these benefits is described as increased information and knowledge dissemination. The more conversations and discussions that are conducted between different people with different perspectives, the more knowledge spread. This is also described as creating a better understanding between the different actors on the market. A majority of respondents describe that this increased knowledge and information dissemination tends to make construction projects more efficient, which can be strongly linked to the theory presented by Bondesson & Erlingson (2012) and Dutta (2012).

SALAR (2009) describes the private actor as profit driven. This entails cost-effectiveness and cost awareness in the market, which in turn generates a willingness to develop, improve and develop innovative solutions to problems.

Respondents in the study describe that the cooperation brings about the possibility for the public sector to influence the market. The demand from the public sector is thus governed by the project proposals received, for example in the project competition. If the public actor is demanding sustainable construction, the private actor creates competitiveness if it focuses on the required requirements, in this case quality and sustainability. Through the increased dissemination of information and knowledge, respondents describe that increased efficiency is created in the market leading to innovative solutions.

6.6.2 Perceived difficulties with public-private partnership

Bovaird (2004) describes that trade unions have been critical of PPP as they believe that working conditions can deteriorate while jobs can be reduced. At the same time, the public has criticized the involvement of profit-driven private actors in the public interest (Bovaird, 2004).

A majority of respondents do not experience any significant difficulties or disadvantages in the PPP partnership. According to a majority of respondents, cooperation is needed to be able to carry out major municipal construction projects and develop sustainability in the construction sector. Through cooperation, the construction process can be streamlined while increasing the spread of knowledge, which leads to innovative solutions. None of the respondents felt that working conditions deteriorated or jobs were reduced, as presented by Bovaird (2004). A majority of respondents instead highlight that there is a shortage of skilled labour in Sweden at the present time.

Another risk with PPP is described as unclear definitions within the project processes, which can lead to elaborate discussions with increased capital costs as a consequence. Extracted discussions may also lead to delays of the project and budget transfers that may in turn affect the core activities of the facility, such as hospitals or schools (SALAR, 2009).

One of the respondents describes the importance of trust in the cooperation. At the same time the importance of clear definitions in contractual agreements and that they are followed by each actor. The same respondent describes a lack of knowledgeable staff who can develop these agreements within the cooperation. In order to increase trust in cooperation and at the same time reduce the risk of unclear definitions, experience and prior knowledge about collaboration require. The result can therefore be partly linked to the presented theory of SALAR (2009).

7 Discussion

This chapter deals with the study's research questions presented in Chapter 1. The chapter aims to address research issues by linking results and analysis with background empiricism and introduction.

The research issues addressed in this study and discussed further in this chapter are;

- What are the perceived advantages and disadvantages with wood as building materials in the construction of apartment buildings?
- What factors control the choice of building materials for major construction projects within the municipalities?
- How can PPP combined with wood construction be a potential tool to address complex issues such as the climate issue and housing shortage in Sweden?

7.1 What advantages and disadvantages are perceived with wood as building materials?

Respondents' answers to the question about the advantages and disadvantages experienced with wood as building materials vary. A majority of respondents describe the material as renewable and acts as a carbon sink in nature. Therefore, the material is described as more environmentally friendly compared to other competing materials on the market.

Other benefits highlighted by the respondents are more efficient construction processes through prefabrication, better working environments, increased competition on the market and the availability of raw material in Sweden. The result of the study can be linked to the empirical background where Larsson et al. 2016 describes wood as renewable and more climate friendly, Nilsson (2017) highlights the possibility of prefabrication and Svensson (2015) highlight the material's beneficial physical properties.

The respondents were generally perceived to have a positive view of wood as a building material. However, another important aspect was raised as significant on the choice of different building materials, which refers to the different both the advantages and disadvantages of all the building materials on the market. Depending on the project or building to be constructed, the materials are therefore suitable for different projects. It also depends on which visionary entrepreneurs have on the project. It was described from the majority of respondents that combinations of different building materials may be the future, and that wood will thus increase in importance in the construction sector in the coming years.

Government Offices of Sweden (2018) have during 2018 published a document that highlights wood as a beneficial building material and where Sweden should take advantage of this invaluable resource. To be able, in future, to respond to the climate targets formulated in the EU, wood can be a good tool.

It should be added that two of the respondents, as representative of the municipality, would not answer this question. This was based on the fact that the municipality does not want to decide which material is better than others. These respondents describes that politics should be neutral to technology, that is, not to favour different types of technical solutions. Respondents' different answers to the question are perceived as both gratifying and with concern. Given the respondents ' answers on how the municipality can make demands in

connection with land display competitions and land allocations, the municipality is deemed to be able to answer how they experience different building materials and the advantages and disadvantages of them. At the same time, the results of the study show that a majority of respondents responded to this question, which is described as gratifying. Wood as a building material is raised in both the media and among researchers presented as a more climate-friendly material.

Respondents also experience disadvantages of wood as building material. Some of these are described as historical myths about fire safety and where there is an idea of increased project costs on the market. However, these are dismissed as myths that are linked to Sweden's fire history. As discussed at the beginning of this work, Sweden was caused by heavily fiery during the seventeenth and eighteenth century, which became the basis for the introduction of a ban on wood construction in the country (Hellsborn & Nilsson, 2010). Respondents believe that these myths are still on the market, which is counteracted by increased knowledge and dissemination.

Other disadvantages described by the respondents are lack of experience and knowledge, few producers of building elements and increased costs. A majority of respondents believe that cost and knowledge correlate where an increased experience of building materials and working methods can contribute to lower costs. One respondent believes that the sustainability and climate aspects of wood as a building material outweigh the costs associated with the project.

The empirical chapter also deals with the sound insulation ability and sensitivity to moisture linked to wood construction. Although these were raised by respondents during the interviews, however, these problems are described as factors related to older construction technology. Therefore, these problems are described in wood buildings in line with the ongoing development and innovation pace of the market.

7.2 What influences the choice of building materials?

The majority of respondents describe that the municipality has a high availability of what is built on municipal land. Through the project contests and market allocation, the municipality may impose certain sustainability requirements which govern the tenders received from the municipality. However, it was not one of the interviewed respondents who wanted to determine which building material should be used. Respondents describe that they instead try to control the market through requirements such as functionality, environment or climate requirements. By placing these requirements, wood as a building material will therefore have certain advantages, and the municipality may therefore submit proposals for wood construction. Therefore, a majority of respondents describe that the choice of building materials is a combination of what the public actor requests in the project competitions and what the private actor enters for tender or competition proposals.

One of the respondents describes that politicians play a crucial role in the selection of building materials on the market. The policy building framework, for example, regulates the costs and size of the building. Another respondent believes that analyses of which material is best suited for a particular project are often lacking and that the construction sector is happy to use proven materials and methods, usually concrete and steel.

A majority of respondents believe that in general there will be higher demands on climate neutrality and reduced climate emissions in construction projects in Sweden. Then it is up to

companies, regardless of the materials used, to be able to meet the demands of municipalities and the market.

Respondents' responses indicate that the municipality has high availability of the type of building that is being built through the requirements of the project contests. At the same time, the market is described as conservative and the builders have a significant role in the materials used in the construction projects. Depending on the tenders and proposals submitted to the municipality, therefore, the municipality's role in the determination of building materials is limited and this role has been transferred to the private actors.

7.3 What is the use of public-private partnerships?

The results of the study show a positive view of the collaborative form PPP among respondents. Through this form of collaboration, the building process tends to be streamlined, while the spread of knowledge increases in the market. Through this form of cooperation there is increased competition on the market, while the possibility for the municipality to influence the market arises.

Wood as a building material is described through the study's empiricism as a more climate-friendly and energy-efficient material, which also the respondents in the study raised as some of the material's benefits. Therefore, the material is described as a good tool to partly reduce the climate impact of the construction sector and at the same time respond to EU climate goals. This in combination with the material enables prefabrication which tends to streamline the construction project while the working environment radically improves for the construction workers. Most respondents believe that in the future there will be higher demands on climate neutrality and reduced climate emissions in construction projects in Sweden. Therefore, the results of the study describe that wood can be a potential tool to meet complex issues such as climate emissions in the construction sector.

However, knowledge and experience, among both private and public actors, are described as the most limiting factor for wood construction in Sweden. This in combination with the conservative construction industry that is happy to use proven materials and methods. Steel and concrete have been leading the market for a long time, which means that the industry has been adapted to these types of projects and methods. Therefore, there is some inertia in the market that has created an ignorance of the wood as a building material but also around the new methods linked to wood construction.

According to NBHBP (2018b) housing market survey, 243 municipalities in Sweden find that there is a deficit of housing within the municipality. To address housing shortages in the country requires effective construction methods that streamline today's construction technology. In the study's results, empirical theory and theory, wood is treated as building material, but also the PPP partnership. This shows that PPP combined with wood construction brings increased efficiency, increased innovation development, greater dissemination of knowledge and better working environments. At the same time, more interests can be met through this form of cooperation and, therefore, PPP, combined with increased wood construction, is described as a potential tool for addressing complex issues such as climate issues and housing shortages in the country.

8 Conclusions

This chapter presents the conclusions of the study. The purpose of this chapter is to highlight the overall conclusions that emerged from the study and to answer the study's purpose.

8.1 Conclusions of the study

The purpose of this study is to explain the importance of public-private partnerships for major wood construction projects in Sweden. The underlying ambition is to understand how municipalities in Sweden use public-private partnerships in major construction projects and how this collaboration, through increased wood construction, can contribute to a more sustainable urban development. The work focuses on the perceived advantages and disadvantages of wood as building materials and how private and public actors on the market can benefit from collaborating.

The results of the study show that the respondents have a positive view of the building material wood. Most of the respondents have had construction projects within the municipality that are carried out with the building materials wood where also the collaboration form PPP is applied. The main advantages of wood as a building material are described as the possibility of prefabrication, climate-friendly material and increased competition in the construction market. Prefabrication describes improve the work environment and improves the efficiency of the building process. The increasing competition on the market is described as positive, as different materials tend to stimulate each other. The increasing wood construction thus means that the concrete industry raises its ambitions and seeks a carbon neutrality and functionality to maintain its market share. The disadvantages that the respondents highlight with the building materials wood are described as lack of knowledge and experience, shortage of producers of building elements in wood and that costs tend to increase. This cost is described as correlating with the knowledge shortage experienced in the field.

A majority of respondents describe that the municipality is working closely with private actors in major construction projects. These partnerships are described as increasing the spread of knowledge between market actors, which is perceived as very positive. Other benefits that are described in the form of cooperation are that there is an opportunity to influence the market and that different risks linked to the projects can be spread between the actors involved. Respondents describe that there are few disadvantages linked to PPP. The disadvantages that emerged from this study are described as lack of skilled labour and there is a difficulty in meeting the different interests in the cooperation.

Public-private partnership is mainly used through project competitions and land display through open procedures. Through these project competitions, the municipality may make certain requirements in connection with the project and thereby to some extent influence the tenders presented. None of the respondents in this study want to be ruling about which building materials to use. On the other hand, certain functionality and sustainability requirements could be set in the project competition and thus the municipality can partly control the project. The municipality also has a great deal of control over the municipal land, where more demands can be made on the choice of building material and method selection.

The study reflects views that there is a positivity to wood as building material and the collaborative form PPP. Through this form of cooperation, actors' different strengths can be

mixed while major projects and challenges can be addressed. A majority of respondents believe in an increased wood construction in the future and in most of the municipalities that were included in this study, wood as building material are currently being used in construction projects within the municipality.

Previous research shows that construction projects carried out with wood as material have a significantly lower climate impact than similar construction projects carried out in the material concrete, which is also experienced by the respondents in this study. At the same time, the results of the study show that the collaborative form PPP is perceived to generate increased efficiency, better knowledge diffusion and increased innovation development in the construction market. At the same time, more interests can be met through this form of cooperation and the municipality has an opportunity to influence the market. Therefore, PPP, combined with increased wood construction, is described as a potential tool for addressing larger and more complex issues such as climate issues and housing shortages in the country. Through the results of the study and the literature review carried out, PPP, in combination with wood as building materials, is described as giving an opportunity to develop a more sustainable urban development.

8.2 Suggestions for further research

A proposal for future research is to investigate the land display competition that the municipalities largely use to locate knowledgeable local labour, and thus initiate cooperation. In this study it was found that the municipalities use different scoring systems in the selection of tenders. Depending on how the tender meets the requirements and wishes that form the basis of the construction project, each tender will receive different points. It would therefore be interesting to do a study focused on the initial stage of the cooperation between public and private actors in the municipalities, linked to major construction projects.

Another suggestion is to investigate further about the perceived advantages and disadvantages of wood as a building material among politicians and other public actors. As this study showed there is a perceived lack of knowledge in the market, it would therefore be interesting to make a larger quantitative study, for example, aimed at the perceived advantages and disadvantages surrounding wood construction. Through such a study, the researcher can also examine how the governance on the market looks like and how politicians communicate and relate to this more climate-friendly building material, wood.

9 Bibliography

The information gathered for this work has been located in several different search engines. Therefore, the sources used in the work have been divided into different categories;

- Literature and publications
- Internet
- Laws, directives and regulations

All the sources used in this study are presented below.

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Personal Messages

Anders Hollinder, Uppsala municipality. 2018-05-16
Carina Toro Hartman, Örebro municipality. 2018-05-16
Johanna Wiklander, Linköping municipality. 2018-06-20
Josephine Nellerup, Malmö municipality. 2018-06-28
Lars Kallsäby, Västerås municipality. 2018-05-28
Torsten Svenonius, Solna municipality. 2018-05-16
Ulrik Berg, Umeå municipality. 2018-06-20

Appendicies

Appendix 1. Interview guide

Interviewer: Fredrik Sjöström
Respondent: Representatives from different municipalities in Sweden

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Interview implementation:

Presentation of the Interview:
The interview is divided into three different areas:

- **Wood as a building material** (bearing material in, for example, multi-family houses)
- **Public-private partnerships**
- **Future prospect**

The interview is expected to take About 30 minutes, depending on the respondent's answer.

The municipalities have been selected for this study as, according to SCB, is one of the 15 municipalities that produced the most apartments in newly built multi-family houses in the last 3-5 years. Respondent's answers are being discussed in chapter 5 "Results" and are presented in continuous text together with the answers of other respondents.

Presentation of the purpose of the study
The purpose of this study is to highlight the importance of public-private partnerships for major wood construction projects in Sweden. The underlying ambition is to understand how municipalities in Sweden use public-private partnerships in major construction projects and how this collaboration, through increased wood construction, can contribute to a more sustainable urban development. The work focuses on the perceived advantages and disadvantages of wood as building material and how private and public actors on the market can benefit from collaborating.

- **Interview Summary Agreement**

  - The respondent's answer is compiled in an interview summary. This summary is then sent back to the respondent by mail for approval of the summary but also for continued treatment in the study.

  - Approval of the recording of the interview and the use of the material in the compilation

- **Short presentation about the respondent's duties and responsibilities**

  - Main task

  - Main area of responsibility

Wood as a building material (bearing material in multi-family houses)

1. Which advantages and disadvantages do you experience with wood as a building material compared to other competing materials such as steel and concrete?
   - Environmental effects?
   - Prefabrication?
   - Increased/decreased efficiency? (time, cost, work environment)
   - Sound transmission between different floors?
   - Problems with stability In wooden houses?
   - Other?

2. What challenges do you experience with using wood as a building material for major construction projects?
   - Raw material/building materials?
   - Knowledge/experience?
   - Costs?
   - Other?

Cooperation between public and private actors in major construction projects

3. Do you cooperate with private companies in major construction projects within the municipality today? If Yes-how does the division of labour look in areas such as;
   - Planning?
   - Financing?
   - Implementation?

4. What benefits do you experience with the public-private partnership??
   (4.1 What benefits do you experience about cooperation with private actors in major construction projects in the municipality today?)
   - Improved/decreased efficiency/cost-effectiveness?
   - Increased knowledge diffusion between actors involved?
   - Increased innovation/innovation rate?
   - Other?

5. Have you experienced any difficulties/disadvantages of the form of partnership public-private partnership? *(5.1 Have you experienced any difficulties/disadvantages in the collaborations you have today with private companies?)*
   - Difficulties in measuring project costs
   - Reduced/increased knowledge dissemination?
   - Access to local skilled labour?
   - Complex agreements?
   - Other?

6. What are the main factors governing the choice of building materials for major construction projects within the municipality today?

Future prospect (Wood construction)

7. What limits construction in wood in general, as you see it? – How do you think the use of wood as a building material will develop in Sweden in the future?

8. Do you have any major construction projects in the municipality where you use wood as a bearing material today? – What does the municipality's planning/strategy look like regarding wood as building material?

- Is there anything else you would like to add? Was there any question you thought was missing in the interview and which you think would be of interest to this study?

Many thanks for your participation as a respondent and for your wish to tell us about the municipality's work in this study! I send an interview summary for approval by mail.

May I return if more questions appear?

Appendix 2. Collaborative design between private and public actors

Respondents answers to question 3 from the Interview guide:

Do you cooperate with private companies in major construction projects within the municipality today? If Yes - how does the division of labour look in areas such as;

- Planning?
- Financing?
- Implementation?

Solna Municipality. *Svenonius, T*

The municipality of Solna works in close cooperation with the builders who carry out the construction projects.

In Solna, large parts of the land are owned by other actors and it is usually this actor's own initiative to start a construction project. This is considered an advantage from the municipality as there is an actor in the cooperation already from day one when a plan assignment is given from the municipal council. The property owner/builder is primarily responsible for producing and presenting a proposal. The municipality conducts the planning process and submits the views that are considered essential to meet the municipality's overall objectives in planning.

The proposals are dealt with through a continuous process with many reconciliations between the municipality's officials on the planning department and the managers of the developer before it comes to the building board to make a decision to go out in consultation.

Much of the submissions and proposals are made by the developer himself, but it is the municipality that has the main responsibility for the plans.

The municipality runs the planning process and provides feedback on the proposals presented by the developer. The developer owns the implementation of the construction and is also responsible for the financing of the project.

Uppsala Municipality. *Hollinder, A*

Uppsala Municipality collaborates with building contractors in major municipal construction projects.

The municipality has different roles:

- As an authority - responsible for building permit issues
- Developmental function. Provide good environments for housing, business and urban planning.
- Build homes that are "affordable". This means, for example, reasonable rents.
- Poison- and fossil free society. Targeted to become climate-positive in 2050.
- Overview plans - to develop Uppsala city over time.
  The municipality uses some control of what is being built in order to reach the municipality's visions and future goals.

The municipality has a plan that describes where it will be built and planning program to describe the qualities and durability aspects that the municipality wants to highlight.

Municipal land ownership means that the municipality has a large control of what is being built. Through the land allocation process, the municipality sells land that builders construct housing. This land allocation is conducted through a so-called land display competition. The municipality can demand certain qualities in different districts and within individual quarters through the land display competition. Subsequently, the builders are invited to present their proposals. The municipality describes what is requested on the ground but does not want to be completely demanding.

There are some basic requirements in the land allocation process, but the municipality does not want to impose excessive demands as there is a risk that the builder only does what is included in the requirement, and nothing beyond that. The municipality wants to see entrepreneurs who think bigger and come with their own suggestions and approaches to achieving sustainability requirements as well as what is feasible to build. Therefore, the municipality wants to be careful to be in control in its claim. The municipality sees it as positive if entrepreneurs think long-term life cycles and develop innovative solutions. However, this can be difficult because the construction industry is partly conservative and there is some inertia in the industry.

Through this collaboration, both the municipality and the developer can get a good idea of what to do and what the developer is capable of building.

Västerås Municipality. *Kallsäby, L*

Västerås Municipality collaborates with private companies in major municipal construction projects. Västerås has grown strongly in recent years. 4 years ago, 3-400 homes a year were built, now being built over 1100 homes a year. This would not have been achieved without a good cooperation within the municipality.

The municipality has largely allocated all the land owned by Västerås. This allocation of land has taken place partly through purely tendering procedures or land display competition. In these land display competitions, instruction have been designs or requirements for, for example, wood construction. The municipality does not own much land today, but most of it is already built. It is also built on private land where the municipality is involved in planning of the projects.

The choice of building materials is not individual to the municipality but the entrepreneurs on the market must also highlight and demand for example wood construction within the projects.

- The municipality brings in tenders for construction projects. In the project description, the municipality may make certain demands, such as environmental requirements, to control which tenders are received. After that, the developer can submit proposals for what they want to build and how they want to go into the project. In some tenders, wood has been proposed as building material, which the municipality has experienced as positive.

At land allocation the municipality can be more decisive compared to, for example, building permit issues.

Örebro Municipality. *Toro Hartman, C*

There are collaborations within the municipality today where building contractors are responsible for the construction.

The municipality is an authority which means that they cannot give competitive advantages to individual companies. These competitive advantages may, for example, be that the municipality takes a determining role about which building materials will be used in certain projects, thereby giving competitive advantages to certain individual companies. This is regarded as important in the municipality, not to be determining, and thus giving competitive advantages to individual contractors.

Within the municipality, discussions are taking place on this more decisive role linked to construction projects. Some parties in the municipality believe that the municipality can be in a more determining role, for example, on the choice of building materials. However, the municipality is an authority that entrepreneurs must be able to trust and which does not give different companies competitive advantages.

The municipality, on the other hand, can indirectly control the type of construction to be carried out in certain projects through the land display competition. Through the competition, the municipality may, for example, demand "environmentally sustainable construction", thus allowing the municipality to indirectly control what to build and what is required for certain projects. In this way, the municipality can partly control which proposals and tenders arrive at the municipality and depending on the requirements specified in the land display competition, some suggestions may include wood as a building material.

The municipality collaborates with entrepreneurs by having an open dialogue about the projects. The municipality and the private actors meet regularly on, for example, business meetings where the projects are discussed. The municipality also meets with companies regularly when they apply for land to be built on. In Örebro, a lot of land is owned by the municipality and if any actor wants to build on a selected area, the municipality will remain on the ground until the project begins.

Companies receive an option on the ground, which means that a contract is signed and a payment of 1 year is paid. During this year, the municipality has meetings with the company on what is appropriate to build on this particular site. Should the company not start the project within this year, the company can extend this time by 1 year but if the construction is not started during this extended period of time, the municipality will interrupt the cooperation and any other builder will be given the opportunity to apply for land allocation. This is specified in the contract established.

This means that the municipality does not sell the land until far into the construction process. Through this, cooperation takes place over a longer period of time and the municipality has control over the project far into the process.

Malmö Municipality. *Nellerup, J*

”All urban planning and urban development include a high degree of cooperation”. Malmö municipality cooperates with both projects carried out on municipal land and projects carried out on private land. Depending on whether the project is carried out in municipal or private land, there are different actors involved in the various specific projects. Detailed planning and building permit department in the municipality are usually involved and work closely to the developers at both projects carried out on municipal land, as projects on private land.

The municipality is landowner and sells land through either direct assignation, land display competition or other land allocation procedures. Together with other actors, agreements are being made for land exploitation. The municipality carries out municipal construction projects such as schools and preschools through ”Stadsfastigheter”. Housing is being built by the municipal housing company “MKB”.

In Malmö municipality, there are several types of collaborations at both strategic and operational levels. "It's extremely important to work with these partnerships and networking to move the city."

The municipal planning monopoly, such as the city planning board and planning authority, works on the basis of the municipality's overview plan, focusing on what will be built.

Umeå Municipality. *Berg, U*

Umeå has collaborations within the municipality today, however, these partnerships are described Have been difficult to develop historically within the municipality.

The municipality wants the market to be able to come to the municipality with proposals for projects in order to initiate cooperation.

Through the "Sustainable Construction Network", more collaborations have been developed. The network consists of 7 major actors who plan to jointly build a new district with 3,000 new units in Umeå municipality. In this network, competitors collaborate with each other to jointly develop this project with a strong focus on sustainable construction. The municipality describes that it was the network that planned this project to then put forward the proposals to the municipality. The municipality is very positive to this project and planning process and that the project was initiated by the market.

The municipality's role in cooperation is the planning work. However, the planning of the project is carried out together with the other 7 actors in the network. The municipality sees this cooperation as positive where competing actors can merge and discuss solutions together.

The problems surrounding these collaborations have previously been political values and contradictions where discussions arose about what society should own and not linked to these construction issues. This is considered to be one of the factors that have been inhibiting this form of cooperation within the municipality.

Linköping Municipality. *Wiklander, J*

When land owned by Linköping municipality is to be built, the construction industry is always competing for this project. The municipality always works with land display competitions for housing construction on municipal land and then the industry may submit tenders. Within these land display competitions, on municipal land, the municipality can make requirements such as wood construction.

Linköping municipality uses municipal companies "Leijonfastigheter", which is responsible for the construction of, for example, school and retirement homes, and "Sankt Kors", which is responsible for construction of office space and parking facilities, etcetera.

Johanna describes: "As a city architect, I wish we had more conversations with the municipal companies about wood construction".

There are no public-private partnerships within the municipality today however, this issue will be addressed within the municipality for the future.

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